LEGO mindstorms® education

NXT User Guide

WELCOME TO LEGO® MINDSTORMS® EDUCATION

LEGO® MINDSTORMS® Education is the next generation in educational robotics, enabling students to discover Science, Technology, Engineering and Mathematics in a fun, engaging, hands-on way.

By combining the power of the LEGO building system with the LEGO MINDSTORMS Education technology, teams of students can design, build, program, and test robots. Working together on guided and open-ended engineering projects, the team members develop creativity and problem-solving skills along with other important mathematics and science knowledge. Students also become more skilled in communication, organization and research, which helps prepare them for future success in higher levels of schooling and in the workplace.

The next technology - now.
LEGO MINDSTORMS Education features an advanced 32-bit computer-controlled NXT brick, Interactive Servo Motors, Sound, Ultrasonic and other sensors, Bluetooth communication and multiple downloading capabilities. The icon-based LEGO MINDSTORMS Education NXT Software is built on the LabVIEW™ software from National Instruments, an industry standard with applications in many engineering and research fields.

Curriculum. Inspiration. Support.
The LEGO MINDSTORMS Education website **www.MINDSTORMSeducation.com** is your main resource for curriculum, training, product information and support. Our partners provide a strong network of information, technical advice, and teacher support as well. Carnegie Mellon Robotics Academy is our partner for developing curriculum materials and activities. Tufts University Center for Engineering Education Outreach (CEEO) is our partner for product development, workshops and conferences. In addition, local support is provided by our trade partners. If you are interested in a competitive challenge, check our website to find out more about the FIRST LEGO LEAGUE.

Start here.
This User Guide provides an overview of the components and features in the LEGO MINDSTORMS Education NXT materials.

Enjoy!

LEGO mindstorms education

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Build. Program. Test.

Build

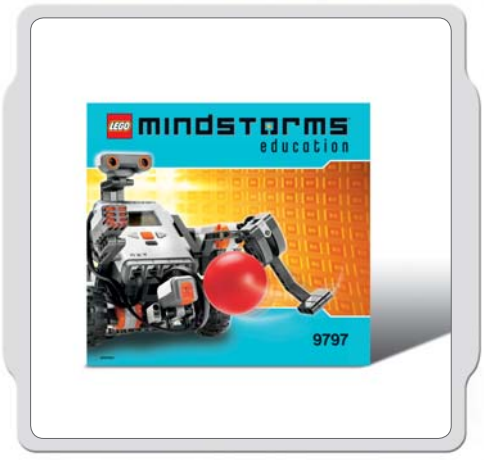
Build your robot. Specific building instructions for a robot are provided with this User Guide. There are also building instructions for the same robot in the NXT Building Guide found in the Base Set #9797 and in the Robot Educator, which is part of the LEGO® MINDSTORMS® Education NXT Software.

Program

Program your robot using the LEGO MINDSTORMS Education NXT Software. Many examples are included in the Robot Educator part of the software. Download your program to the NXT brick with the wireless Bluetooth connection or the USB cable.

Test

Run your program. What happens? Did your robot perform as you expect? If not, adjust your robot or your program and try again!



Start Here

If you prefer to start by building and programming using the NXT brick display without a computer, go to the NXT Building Guide.

Overview

NXT Brick

An intelligent, computer-controlled LEGO® brick, the NXT is the brain of the LEGO MINDSTORMS® Education robot.

Touch Sensors

Enable the robot to respond to obstacles in the environment.

Sound Sensor

Enables the robot to respond to sound levels.

Light Sensor

Enables the robot to respond to variations in light level and color.

Ultrasonic Sensor

Enables the robot to measure distance to an object and to respond to movement.

Attaching the sensors

Sensors can be plugged into any input port numbered 1-4. Any wires except the converter wire can be used to connect the sensors.

The default settings used for the test programs on the NXT and for many sample programs in the Robot Educator are as follows:
Port 1: Touch Sensor
Port 2: Sound Sensor
Port 3: Light Sensor
Port 4: Ultrasonic Sensor

Overview

Lamps & Converter Cables

Add lamps and then program flashing lights, or use them to activate the Light Sensor, or just for fun! Three Lamps and three Converter cables are included in the Base Set.

Interactive Servo Motors

Ensure that robots move smoothly and precisely.

Rechargeable battery

Provides power to the NXT so the robot can move and respond.

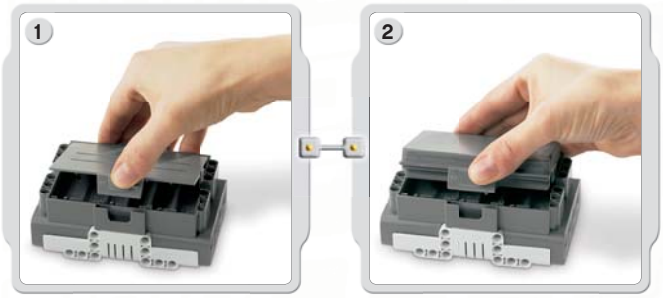
Attaching the Motors and Lamps

Motors or Lamps can be plugged into any output port A, B, or C.

The default settings used for the test programs on the NXT and for many sample programs in the Robot Educator are as follows:

Port A: Motor or a Lamp for an extra function
Port B: Motor for movement; for a two-Motor chassis, often this is the left side.
Port C: Motor for movement; for a two-Motor robot, often this is the right side.

Installing Batteries In The NXT

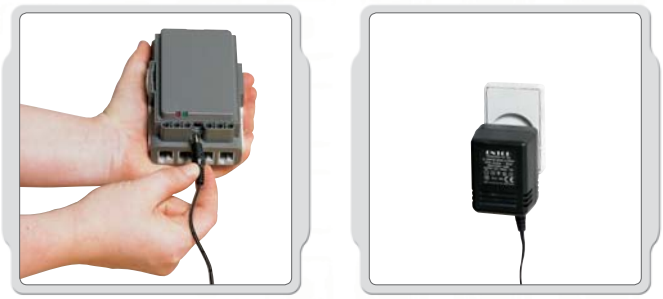


Rechargeable battery

The rechargeable battery fits into the bottom of the NXT. To install the rechargeable battery, move the plastic tab on the side with your thumb to open the back.

The NXT comes with an extra cover that is used when 6 AA batteries are used. (See details on the next page.)

Holding the rechargeable battery, press in the plastic tab and snap the battery into place.



To recharge the battery, attach one end of the power adapter cord (sold separately) into the charge plug just below the NXT input ports. Attach the other end of the power adapter cord into the wall socket. The battery may also be charged when not inserted into the NXT.

- The green indicator light turns on when the power adapter is connected to the NXT.
- The red light turns on when the battery is recharging. The red light turns off when the battery is fully recharged.
- Fully recharging the battery requires approximately four hours.
- The NXT can be used when the battery is recharging; however, recharging then requires more time.
- This Li-Ion Polymer battery can be recharged up to 500 times.

When you first use the rechargeable battery in the NXT itself, attach the transformer and let the battery and NXT charge together for approximately 20 minutes before starting. You may also need to do this if the rechargeable battery was completely depleted before recharging.

Note: You will need to charge the battery first before using it.

Installing Batteries In The NXT

Other battery types

The NXT also operates using six AA/LR6 batteries.

- Alkaline batteries are recommended.
- Rechargeable AA/LR6-type batteries can be used; however, the power performance of the NXT may be reduced.

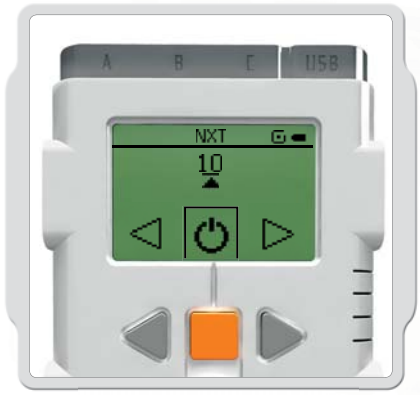
Batteries low

When the battery power is low, this icon flashes on and off in the NXT display.

6x

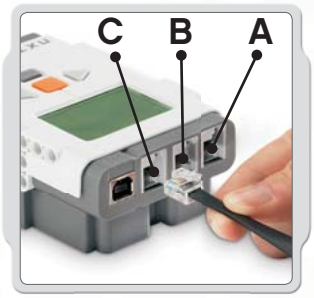
Important!

- Never mix different types of batteries in the NXT.
- Always remove batteries prior to long-term storage.
- Promptly remove depleted batteries from the NXT.
- Only recharge batteries under adult supervision.
- Never attempt to recharge non-rechargeable batteries.



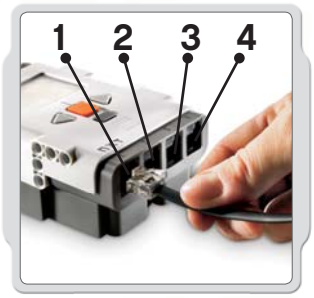
The NXT will Sleep to conserve power. To change the time or set Sleep to Never, go to Settings/Sleep/Never [Settings/Sleep/Never]. You can also change the Settings to wait before going to Sleep from 2, 5, 10, 30, or 60 minutes.

Connecting the NXT Technology



Connecting Motors

To connect a Motor to the NXT, plug one end of a black wire to the Motor. Plug the other end into one of the output ports (A, B, C).



Connecting sensors

To connect a Sensor to the NXT, plug one end of a black wire into the Sensor. Plug the other end into one of the input ports (1, 2, 3, 4).

Downloading and uploading

The USB port and wireless Bluetooth connection are used for downloading and uploading data between your computer and the NXT.

If your computer has Bluetooth, you can download programs to the NXT without using the USB cable.

If your computer does not have Bluetooth, you must use the USB cable or buy a Bluetooth dongle for your computer. (Read more about the wireless Bluetooth connection on pages 34-43).

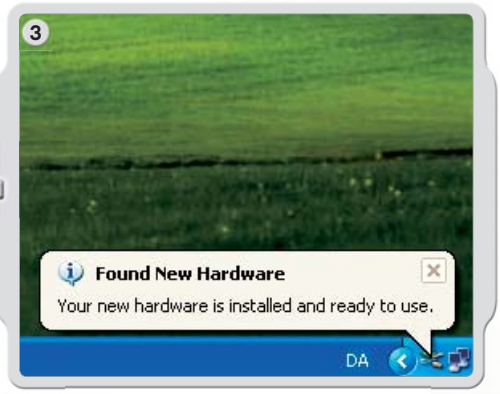
Note that ALL of the black 6-wire cables can be used in both input and output ports, sensors and motors. Work sensors MUST be attached to the input ports (1-4) and motors MUST be attached to the output ports (A-C).

Connecting the NXT Technology

Turn on the NXT.

Make sure the LEGO® MINDSTORMS® Education NXT Software is installed on your computer before connecting the NXT to the computer. See page 44 for installation instructions.

Connect the PC and the NXT with the USB cable.



When the PC identifies the NXT it will automatically finalize the installation of the LEGO® MINDSTORMS® Education NXT Software.

Connecting the NXT to a Macintosh with a USB cable

Make sure the LEGO MINDSTORMS Education NXT Software is installed before connecting your NXT to your Macintosh. (See the installation instructions on page 45.)
Turn on your NXT.
Connect the USB cable to the NXT.
Connect the USB cable to the Macintosh and you're ready to go.

About The NXT Brick

NXT Interface

The NXT brick is the brain of the LEGO® MINDSTORMS® Education robot. It is a computer-controlled LEGO brick that provides programmable, intelligent, decision-making behavior.

Output ports
The NXT has three output ports labeled A, B, and C for Motors or Lamps.

Bluetooth icon
The Bluetooth icon shows the current status of any wireless Bluetooth connections. If there is no Bluetooth icon shown, Bluetooth is Off.

Bluetooth is On but your NXT is not visible to other Bluetooth devices.

Bluetooth is On and your NXT is visible to other Bluetooth devices.

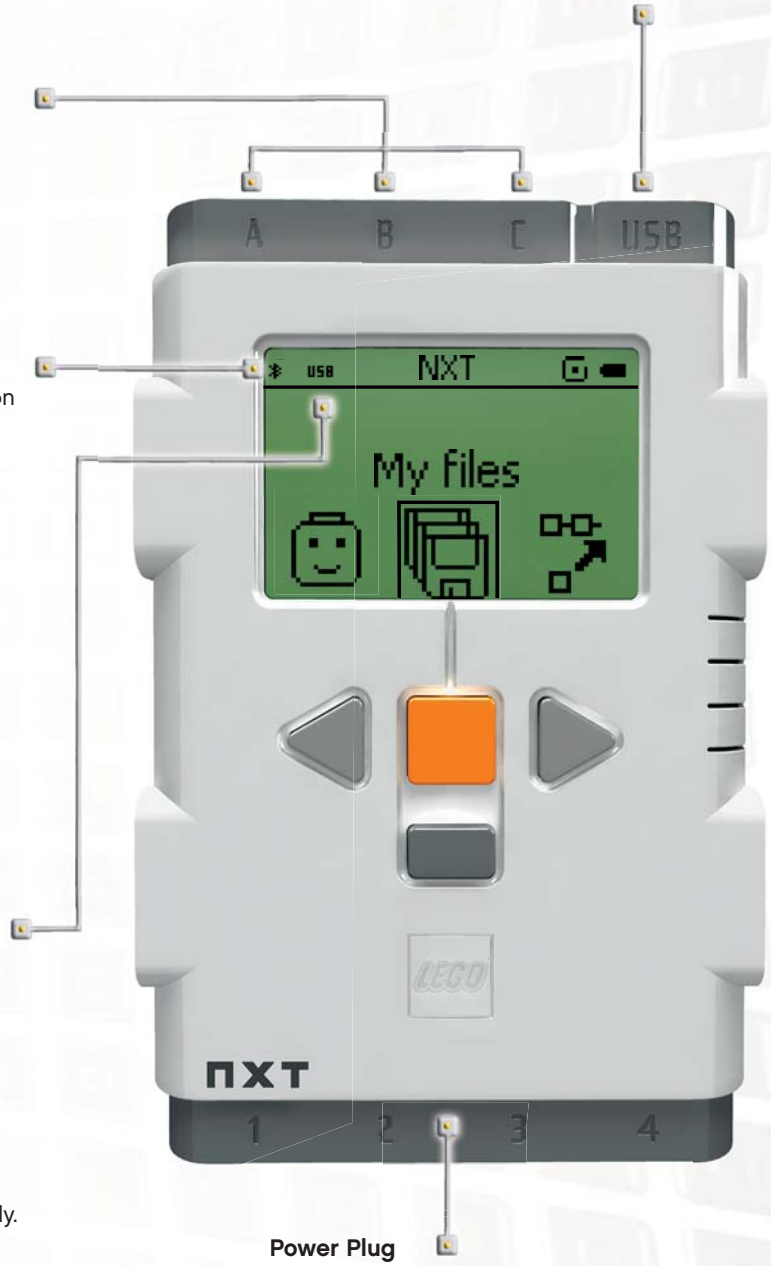
Bluetooth is On and your NXT is connected to a Bluetooth device.

USB icon
When you connect your NXT to a computer with a USB cable, a USB icon will be displayed. If you disconnect the USB cable, the icon will disappear.

USB connected and working fine.

USB connected but not working properly.

USB port
Connect a USB cable to the USB port and download programs from your computer to the NXT (or upload data from the robot to your computer). You can also use the wireless Bluetooth connection for uploading and downloading.



Power Plug
If you are using the rechargeable battery and need to recharge it, or if you are not using 6AA batteries, you can connect a power adapter to the NXT using the power plug. (Power adapters are sold separately.)

About The NXT Brick

Running icon
When the NXT is turned on, the running icon spins. If the running icon stops spinning, the NXT has frozen and you must reset it. (See page 63 for Troubleshooting steps).

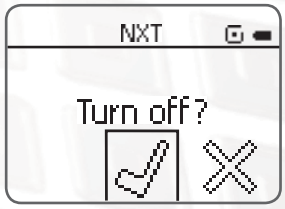
Battery level
The battery icon displays the NXT power level. When the battery power is low (below about 10% capacity), the battery icon flashes on and off.

Loudspeaker
When sounds are included in a program, you can hear them through the Loudspeaker.

NXT buttons
Orange: On/Enter.
Light grey arrows: Navigation, left and right
Dark Grey: Clear/Go back.

Turning off your NXT

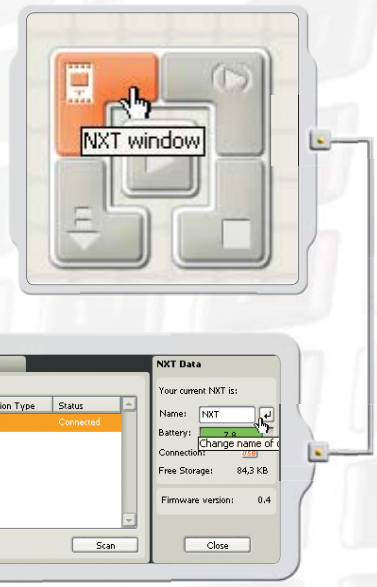
1. Press the Dark Grey button until you see this screen.
2. Press the Orange button to turn off the NXT. Press the Dark Grey button to go back to the NXT main menu.

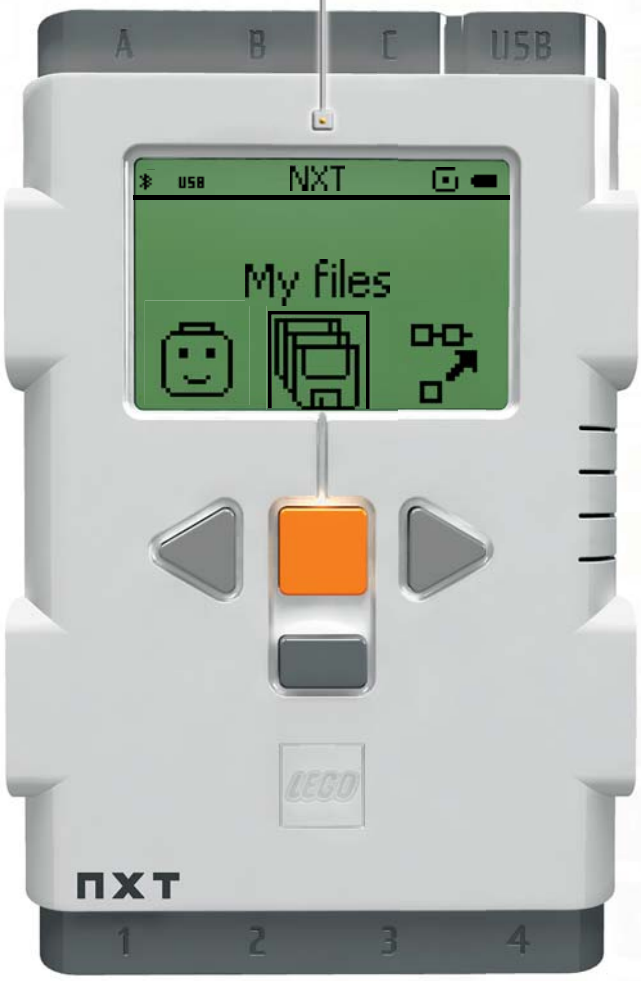


Input ports
The NXT has four input ports for attaching sensors. The sensors must be attached to port 1, 2, 3, or 4.

About The NXT Brick

Naming the NXT
You can change the name of your NXT by going to the NXT window in the software. This window is accessible from the Controller. NXT names can be at most eight characters long.





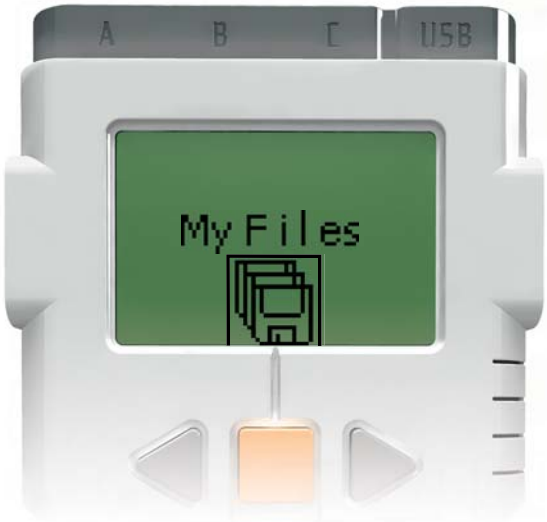
NXT display options
Your NXT has many other features. Read more about them on the following pages.

Technical specifications

- 32-bit ARM7 microprocessor
- 256 Kbytes FLASH, 64 Kbytes RAM
- 8-bit microprocessor
- 4 Kbytes FLASH, 512 Byte RAM
- Bluetooth wireless communication, Bluetooth class II V2.0 compliant
- USB 2.0 port
- Four input ports, six-wire digital platform
- Three output ports, six-wire digital platform
- Dot matrix display, 60 x 100 pixels
- Loudspeaker, 8 KHz sound quality
- Power source: Rechargeable lithium battery or six AA Batteries
- Plug for power adapter: US: 120VAC 60Hz
  UK, EU, AUS: 230˜ 50Hz

NXT Main Menu

My Files



In the My Files submenu you can store all the programs that you have made on the NXT or downloaded from your computer.

There are three different subfolders:

Software files –
programs you have downloaded from your computer.

NXT files –
programs you have made on the NXT.

Sound files –
sounds that are part of a program that you download.

Files are automatically placed into the appropriate folders. When you download a program using a Sound file to the NXT, the program will be placed under Software files while the sound data will be placed under Sound files.

When you Select a file, you can send it to other NXT units. Read more about this in the section Connecting Your NXT to Another NXT on page 42.

NXT Main Menu

NXT Program

You don't need a computer to program a robot. Using the NXT Program submenu, you can make many programs without your computer.

Try this program to see how easy it is.

Make the robot go back and forth when the Touch Sensor is pressed. First, the robot will move forward until the Touch Sensor is pressed, and then it will move backwards. When its Touch Sensor is pressed again, the robot will move forward once again. This will continue indefinitely until you stop the program.

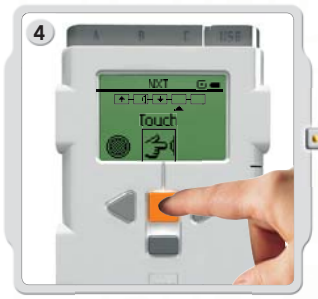
Make sure the sensor and motors are connected to the right ports. The Touch Sensor is connected to port 1. The Motors are connected to ports B and C.

Select Forward. Use the Light Grey Arrow buttons to move through the choices and then press the Orange button Enter to make your selection.

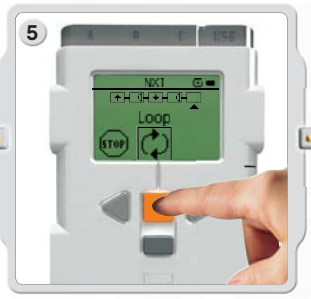
Select Touch.

Select Backward.

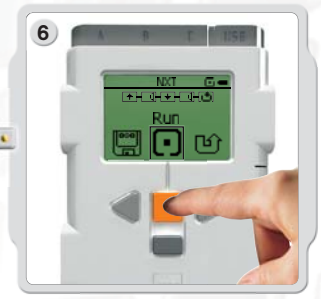
NXT Main Menu



Select Touch again.



Now select Loop to make the program run again and again until you turn off the NXT.

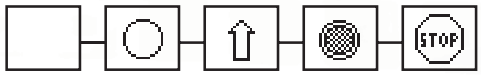


Now you can run the program. Simply select Run.

Try these programs as well.

1.

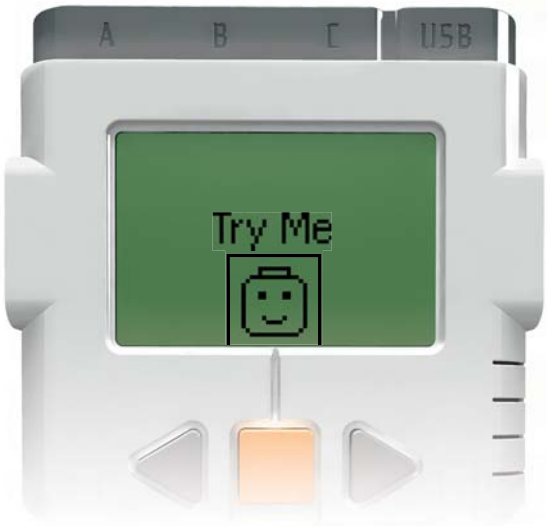
2.

3. 

4.

NXT Main Menu

Try Me

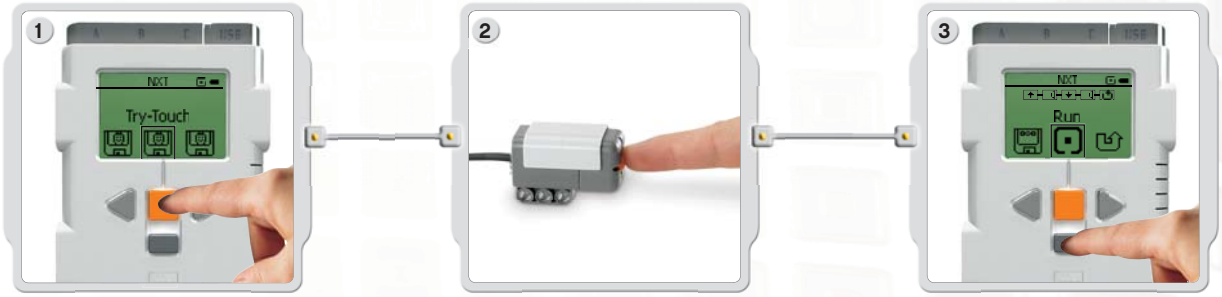


Important

Use the default port settings for the Motors, Lamps and Sensors as explained on pages 5-6. See pages 23-33 for specific examples using each of the Sensors and the Motor.

The Try Me feature allows you to experiment with the Sensors and Motors using programs that are ready to run.

To start, press the Light Grey Arrow on the left to go to Try Me. Then press the Orange button to select Try Me.



Press the Light Grey Arrow to the right to go to Try-Touch program.
Press the Orange button to select it.
Press the Orange button again to Run the Try-Touch program.

Make sure the Touch Sensor is in port 1.
Press the Touch Sensor button.

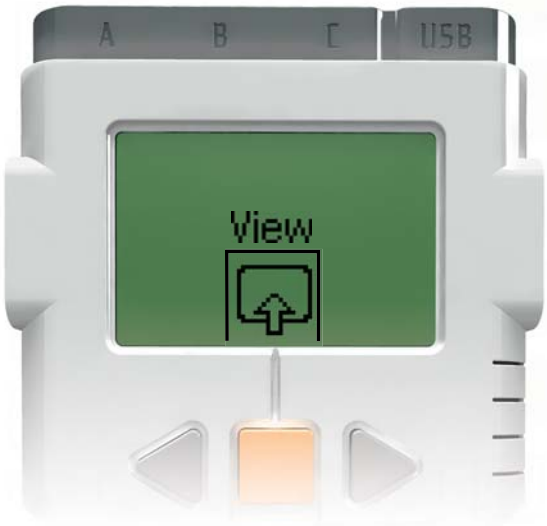
The program Loops continuously so press the Dark Grey button to stop the program.

Select some other Try Me programs to experiment with other Sensors and the Motors.

Try Me files can be deleted in the Settings submenu (see page 19). However, to get them back onto the NXT, you would need to download the firmware again (see page 63).

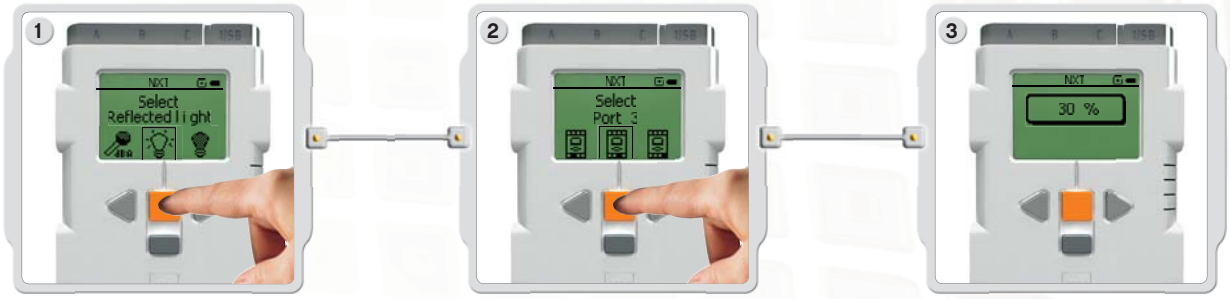
NXT Main Menu

View



In the View submenu, you can do a quick test of your Sensors and Motors and see the current data for each.

Connect Sensors or Motors to the NXT port(s). View will help you select the right port or check the default settings.
Select View in the NXT display.



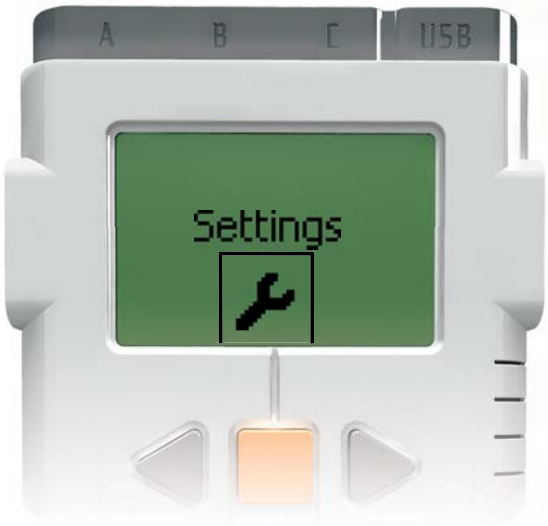
Select the icon of the Sensor or Motor that you want to test. You can only get readings from one sensor or motor at a time.

Select the port to which the Sensor or Motor is attached.

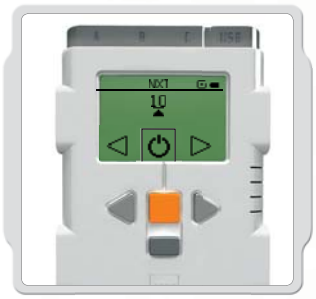
The data from the Sensor or Motor appears on the display.

NXT Main Menu

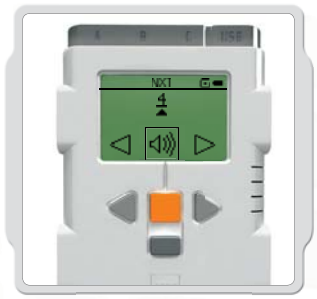
Settings



In the Settings submenu, you can adjust the different settings of the NXT, such as Loudspeaker volume or Sleep mode. In this submenu, you can also delete the programs that you have stored in the NXT memory.



Sleep mode:
You can set your NXT to be turned off after 2, 5, 10, 30 or 60 minutes when it is not being used. You can also select the Never setting so that the NXT remains on until you turn it off. Please be aware that this drains the batteries more quickly.

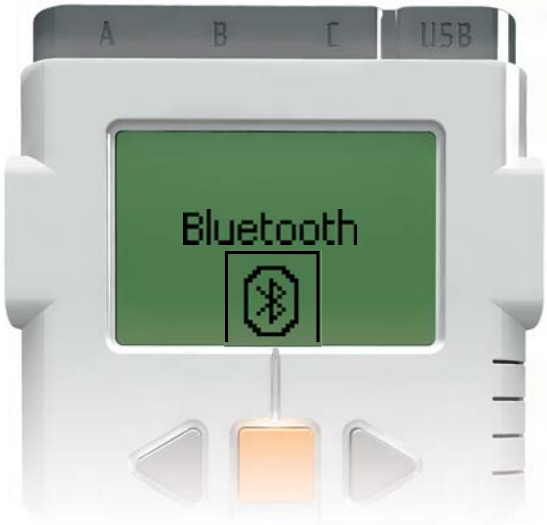


Change Volume:
Here you can adjust the volume of the NXT speakers in a range of 0 (Off) to 4 (Loud).

Delete all programs:
You are able to delete the programs from four subfolders: Software files, NXT files, Sound files, and Try Me files.

NXT Main Menu

Bluetooth - NXT main menu

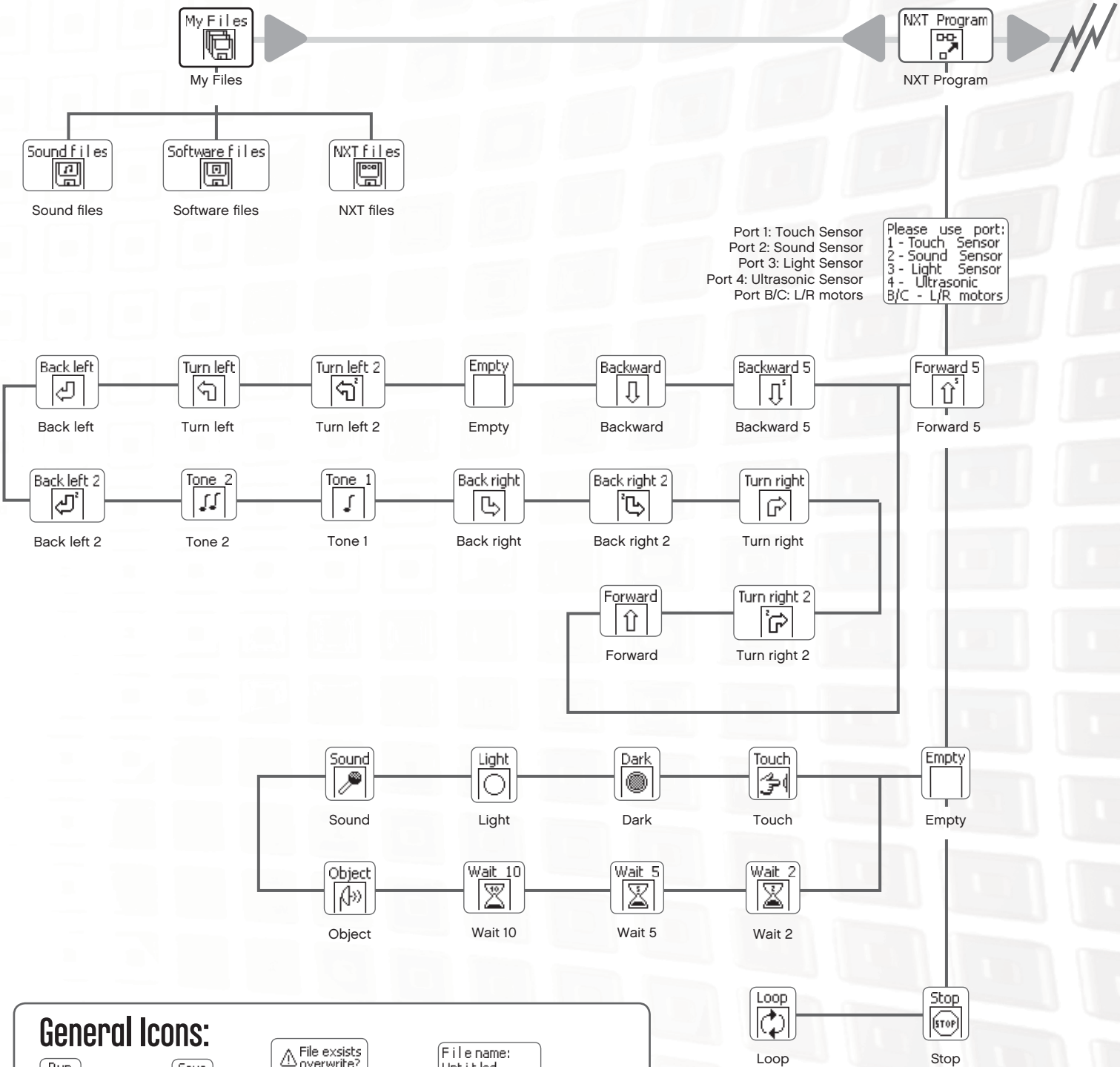


In the Bluetooth submenu, you can set a wireless connection between your NXT and other Bluetooth devices, such as other NXT units, mobile phones, and computers.

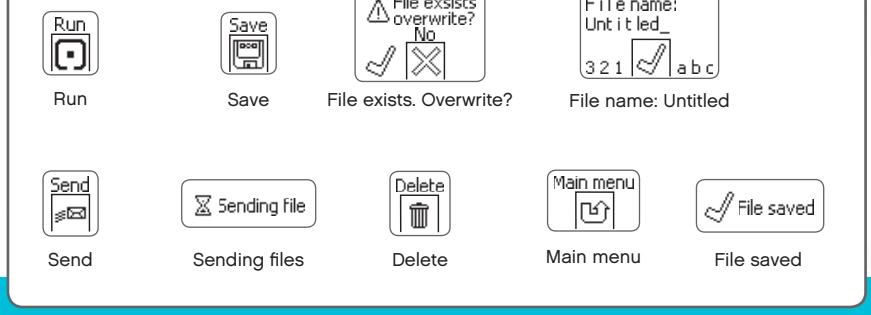
You can use a wireless connection to download programs without using a USB cable. You can even program a mobile telephone to control the NXT!

Read more about wireless Bluetooth communications on pages 34-43.

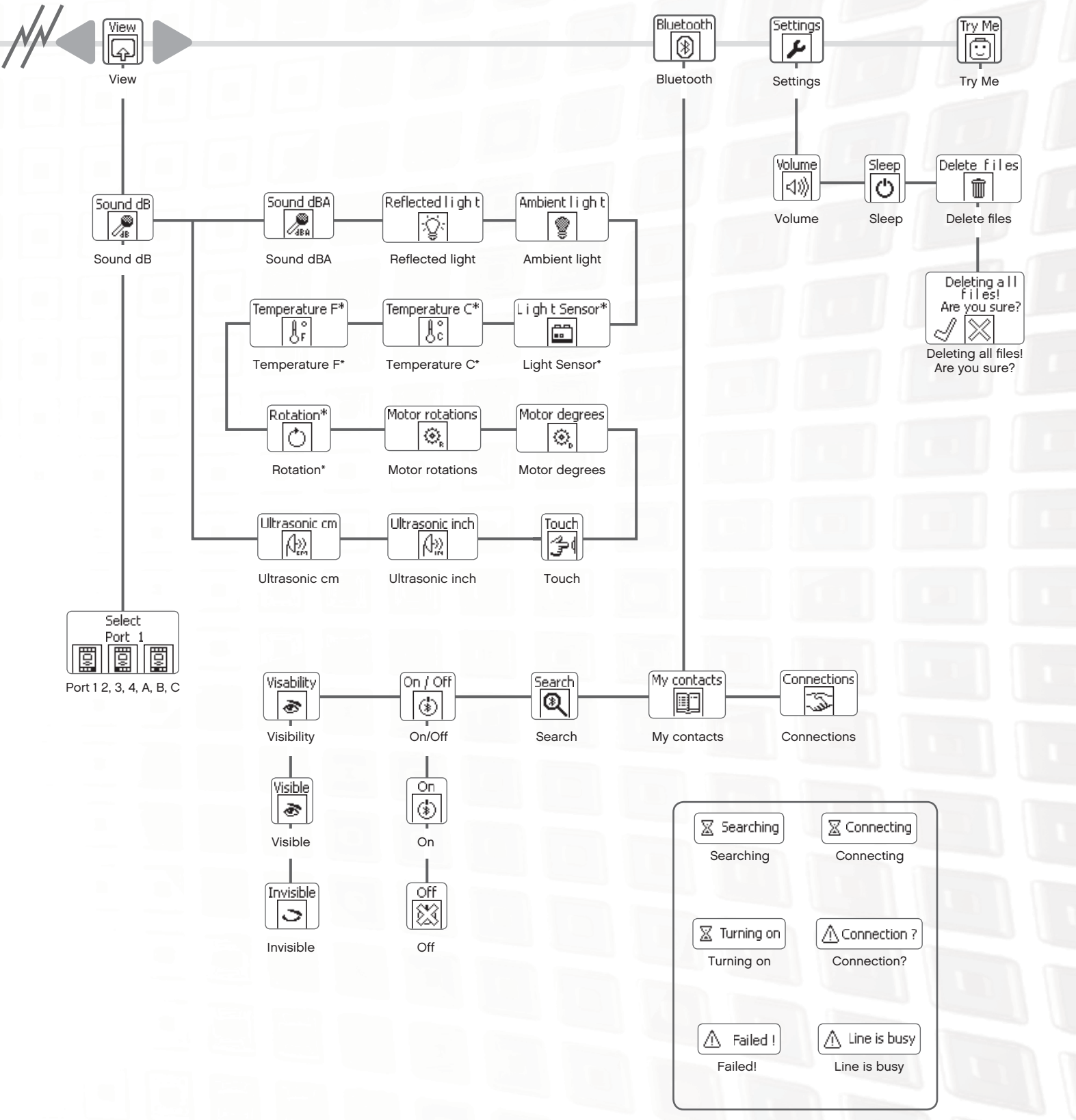
NXT Main Menu



General Icons:

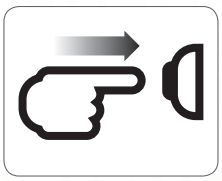


NXT Main Menu

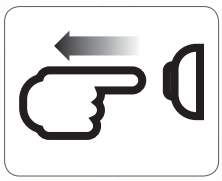


Touch Sensor

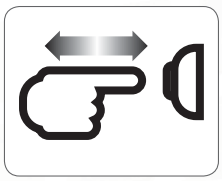
The Touch Sensor is a switch: it can be pressed or released.



Pressed



Released



Bumped

Suggestions for use

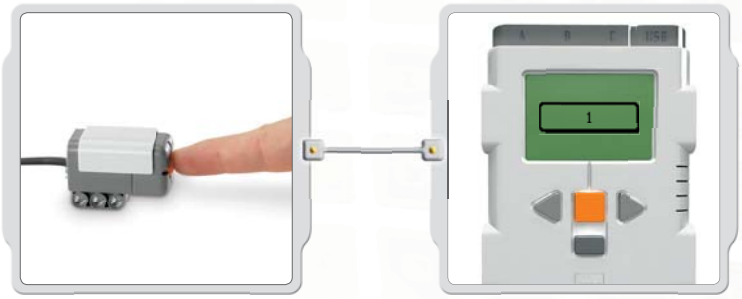
You can add the Touch Sensor to an NXT model and then program the model behavior to change when the Touch Sensor is pressed or released.

Programming ideas using the Touch Sensor are included in the Robot Educator.

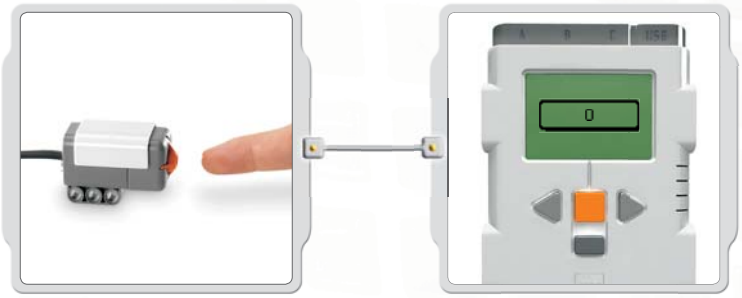
View

See the current Touch Sensor response on the display using View. A zero [0] means the Touch Sensor button is not pressed. A one [1] on the display means the Touch Sensor button is pressed.

Connect the Touch Sensor to NXT port 1.
Select View in the NXT display.
Select the Touch icon.
Select port 1.



Press and hold the Touch Sensor button while watching the NXT display. You should see a one (1) on the display.



Now release the Touch Sensor button.
You should see a zero (0) on the display.

Touch Sensor

Try Me

The Try Me feature (see page 17) includes several programs already prepared for experimenting with the NXT and a Touch Sensor. Using the programs available you can experiment with the following features.

One Touch Sensor and the face on the display:
Using the Touch Sensor you can activate behavior on the display face.

One Touch Sensor and one Sound Sensor:
If the Sound Sensor is active and the Touch Sensor is pressed, the NXT make a sound for three seconds.

One Touch Sensor and one Motor:
The Motor reverses when the Touch Sensor is activated.

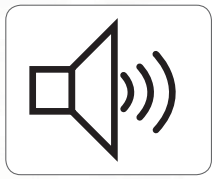
Program

You can also use the Program [Program] feature to create programs right on the NXT without using a computer. See the Program section on page 15 to create a program using the Touch Sensor to turn on and turn off a sound.

Sound Sensor

The Sound Sensor detects the decibel level: the softness or loudness of a sound. The Sound Sensor detects both dB and dBA.
dBA: the sounds human ears are able to hear.
dB: all actual sound, including sounds too high or low for the human ear to hear.

The Sound Sensor can measure sound pressure levels up to 90 dB – about the level of a lawnmower. Sound sensor readings on the LEGO® MINDSTORMS® NXT are displayed in the percentage [%] of sound the sensor is capable of reading. For comparison, 4-5% is like a silent living room and 5-10% is about the level of someone talking some distance away. From 10-30% is normal conversation close to the sensor or music played at a normal level and 30-100% represents a range from people shouting to music playing at high volumes. These ranges are assuming a distance of about 1 meter between the sound source and the Sound Sensor.



Suggestions for use

You can add the Sound Sensor to an NXT model and then program the model behavior to change when the Sound Sensor is activated.

Programming ideas using the Sound Sensor are included in the Robot Educator.

View

Test the Sound Sensor's ability to measure sound volume using View. Connect the Sound Sensor to NXT port 2.

Select View in the NXT display.
Select the Sound dB icon.
Select port 2.

Make sounds into the microphone (Sound Sensor) and see the readings on the NXT. Try also to read the sounds around you: How loud are the nearest voices?

Sound Sensor

Try Me

The Try Me feature (see page 17) includes several programs already prepared for experimenting with the NXT and a Sound Sensor. Using the programs available you can experiment with the following features.

One Sound Sensor and the face on the display:
Using the Sound Sensor you can make the mouth open and close on the display face.

One Sound Sensor and one Touch Sensor:
If the Sound Sensor is active and the Touch Sensor is pressed, the NXT make a sound for three seconds.

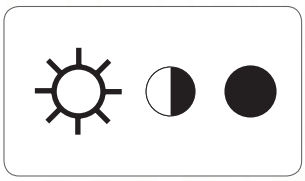
One Sound Sensor and one Motor:
The Motor speed increases as the sound level increases.

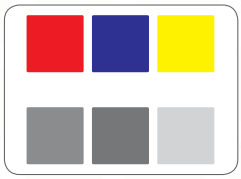
Program

You can also use the Program feature to create programs right on the NXT without using a computer. See the Program section on page 15 to create a program using the Sound Sensor to control a sound.

Light Sensor

The Light Sensor enables the robot to distinguish between light and darkness, to read the light intensity in a room, and to measure the light intensity on colored surfaces.





This is what your eyes see.

This is what your robot sees using the light sensor.

Suggestions for use

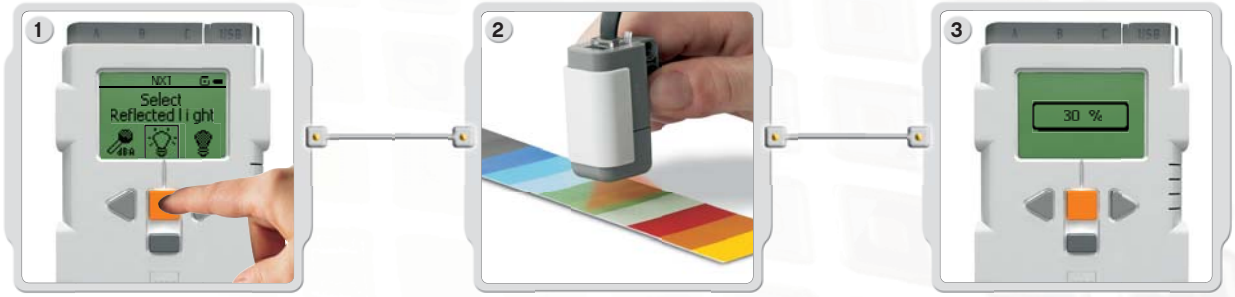
You can add the Light Sensor to an NXT model and then program the model behavior to change when the Light Sensor is activated.

Programming ideas using the Light Sensor are included in the Robot Educator.

View

You can test the Light Sensor in different ways using View.
Viewing reflected light turns on the flood light in the sensor.

Viewing Reflected Light to see Colors
Connect the Light Sensor to the NXT.
Select View in the NXT display.



Select the Reflected light icon.
Select the port in which you have placed the sensor.

Hold the Light Sensor close to the different colors in your surrounding and see the different readings. You can use the color chart on page 66 of this guide or page 69 of the NXT Building Guide.

Light Sensor

Viewing Ambient light
Viewing Ambient light turns off the flood light so that the sensor reads only the light around it.Connect the Light Sensor to the NXT.
Select View in the NXT display.

Select the ambient light icon. Select the port in which you have placed the sensor.

Test the Light Sensor's ability to read the surrounding light by measuring the light level in different parts of the room. For example, first hold the sensor against the window, then hold it under the table. Notice the difference in the readings. Higher numbers indicate more light (as a percentage of the light the sensor can read). Lower numbers indicate a lower amount of light.

Try Me

The Try Me feature (see page 17) includes several programs already prepared for experimenting with the NXT and a Light Sensor. Using the programs available you can experiment with several features. For example, using one Light Sensor and the face on the display: Using the Light Sensor you can make the eyes open and close on the display face.

Program

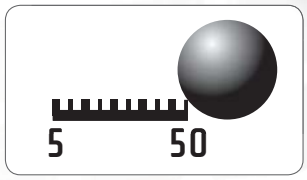
You can also use the Program [Program] feature to create programs right on the NXT without using a computer. See the Program section on page 15 to create a program using the Light Sensor to control a Motor.

Ultrasonic Sensor

The Ultrasonic Sensor enables the robot to see and recognize objects, avoid obstacles, measure distances, and detect movement.

The Ultrasonic Sensor uses the same scientific principle as bats: it measures distance by calculating the time it takes for a sound wave to hit an object and come back – just like an echo.

The Ultrasonic Sensor measures distance in centimeters and inches. It is able to measure distances from 0 to 2.5 meters with a precision of +/-3 cm.



Large-sized objects with hard surfaces provide the best readings. Objects made from soft fabrics, from curved objects (e.g. a ball), or from very thin and small objects can be difficult for the sensor to read.

Suggestions for use

You can add the Ultrasonic Sensor to an NXT model and then program the model behavior to change when the Light Sensor is activated.

Programming ideas using the Ultrasonic Sensor are included in the Robot Educator.

Note: Two Ultrasonic Sensors in the same room may interfere with each other's readings.

View

Test the Ultrasonic Sensor's ability to measure distance using View.
Connect the Ultrasonic Sensor to the NXT.
Select View in the NXT display.

Select the Ultrasonic Sensor icon. Select the port in which you have placed the sensor.

Try to measure the distance to an object. Move the object closer and see the different readings.

Ultrasonic Sensor

Try Me

The Try Me feature (see page 17) includes several programs already prepared for experimenting with the NXT and an Ultrasonic Sensor. Using the programs available you can experiment with the following features.

One Ultrasonic Sensor and the face on the display:
Using the Ultrasonic Sensor to measure distance from an object, you can make the display face become smaller or larger based on the distance from that object.

One Ultrasonic Sensor and sounds:
The pitch of sound increases as the distance to an object decreases.

One Sound Sensor and one Motor:
The Motor speed increases as the distance from an object decreases.

Program

You can also use the Program feature to create programs right on the NXT without using a computer. See the Program section on page 15 to create a program using the Ultrasonic Sensor to control a Motor.

Interactive Servo Motor

The three Interactive Servo Motors provide the robot with the ability to move. Using the Move [Move] block automatically aligns their speed so that the robot moves smoothly.

Built-in Rotation Sensor

The Interactive Servo Motors all have a built-in Rotation Sensor. The rotational feedback allows the NXT to control movements very precisely. The built-in Rotation Sensor measures the Motor rotations in degrees (accuracy of +/- one degree) or full rotations. One rotation is 360 degrees, so if you set the Motor to turn 180 degrees, the hub will make half a turn.

Suggestions for use

The built-in Rotation Sensor in each motor along with the Power configuration in the Move or Motor blocks in the Software (see page 53-55) allow you to program different speeds for your Motors and move the robot accurately.

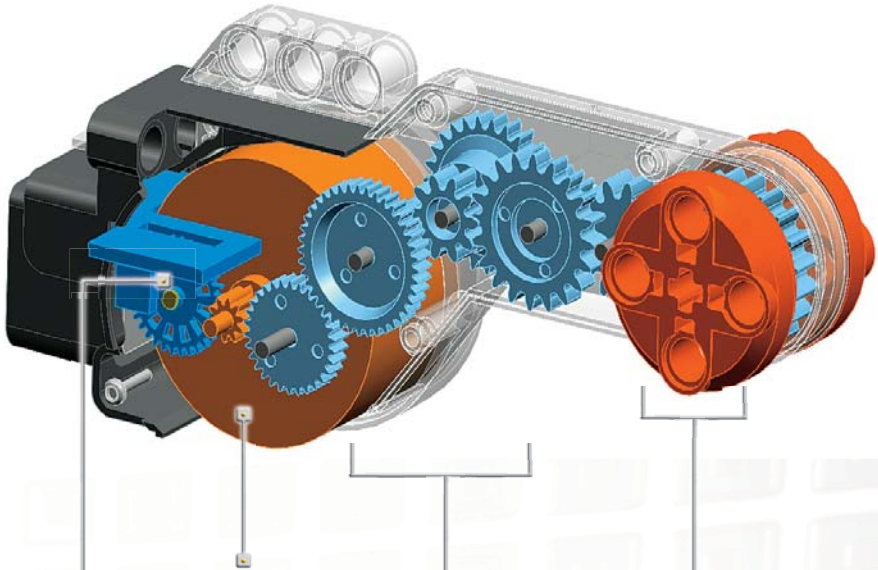
View

Test the Rotation Sensor's ability to measure distance.
Connect the Motor to the NXT.
Select View in the NXT display.

Select the Motor rotations icon.

Select the port in which you have placed the Motor.
Now try to attach a wheel to the Motor and measure the rotations by pushing the wheel over the floor.

Interactive Servo Motor



Try Me

The Try Me feature (see page 17) includes several programs already prepared for experimenting with the NXT and the Motors. For example, try this program controlling Motor and Sounds:
As you turn the Motor, a series of sounds in a scale will be played. The tone increase one note for every 10 degrees. Turning the Motor direction toward the right (clockwise) increases the pitch. Turning the Motor to the left (counterclockwise) decreases the pitch.

Program

You can also use the Program [Program] feature to create programs right on the NXT without using a computer.

See the Program section on page 15 to create a program using the Motors.

Lamps

The Lamps can be turned on and off, creating flashing patterns of light. They can also be used to activate the Light Sensor or to show that a motor is on or to indicate the state of a sensor. You can also use them to liven up your robot “eyes” or other features.

Use the converter cables to attach Lamps to output ports A, B, or C. There are three Lamps and three converter cables included.

View

Use the Lamps to activate the Light Sensor.
Select Ambient Light.

Use the Lamps to activate the Light Sensor.
Select Ambient Light.

Shine the Lamp near the Light Sensor.

Notice that the reading changes.

Using Bluetooth®

Bluetooth®

Bluetooth is a communication technology that makes it possible to send and receive data without using wires. Using the Bluetooth features, you can set up a wireless connection between your NXT and other Bluetooth devices, such as other NXT units, mobile phones, and computers.

Once the Bluetooth connection is set up, you can use it for these features:

- Downloading programs from your computer without using a USB cable.
- Sending programs from devices other than your computer, including your own NXT.
- Sending programs to various NXT units either individually or in groups. A group can contain up to three NXT devices.

If you have a mobile phone with Bluetooth capability, you can use it to control robots. You may even be able to use it as an advanced sensor, such as a camera sensor.

Visit **www.MINDSTORMSeducation.com**, for more information on mobile phone requirements.

Using Bluetooth

Before you set up a wireless Bluetooth connection, make sure that your computer has Bluetooth capability.

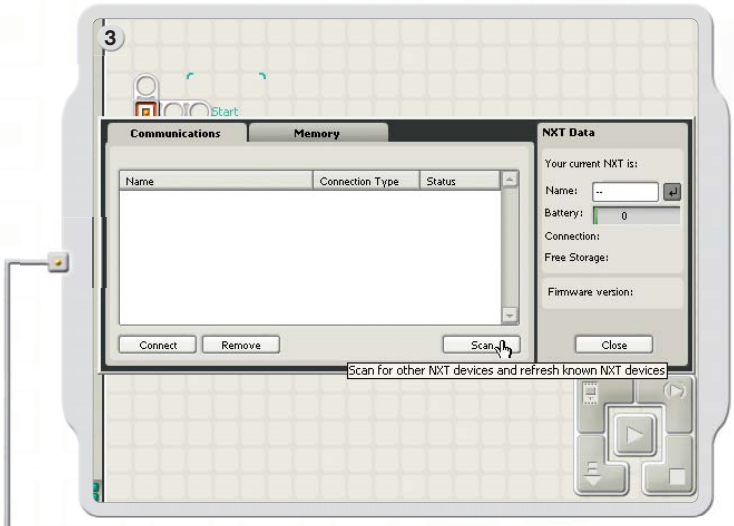
If your computer does not have Bluetooth built-in, you must use a Bluetooth USB dongle. Make sure that you use the right type of Bluetooth USB dongle. Read more about the different types of Bluetooth dongles at **www.MINDSTORMSeducation.com**

Making The Connection To A PC

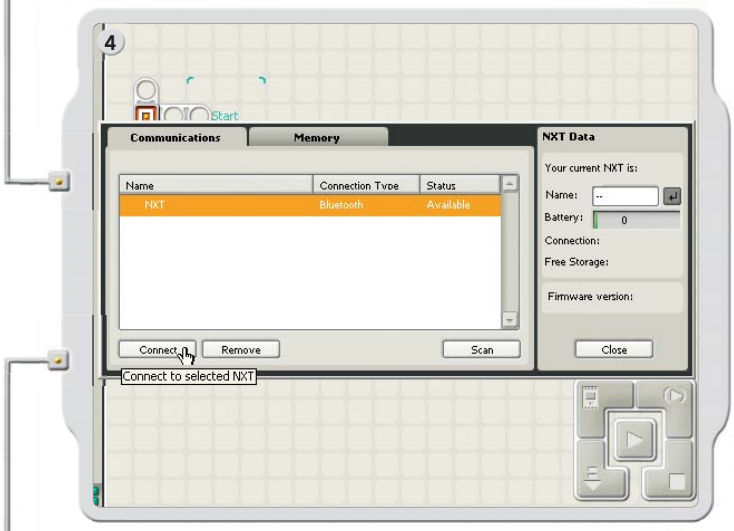
Make sure that the NXT is turned on. Also make sure that Bluetooth is set to On and that the NXT is set to Visible. (Read how in the Bluetooth Submenu on page 40). Also make sure that Bluetooth is installed and enabled on your computer.

Find the Controller at the lower right work area in the software. Click on the NXT window button (the one on the upper left) and the NXT window opens.

Using Bluetooth

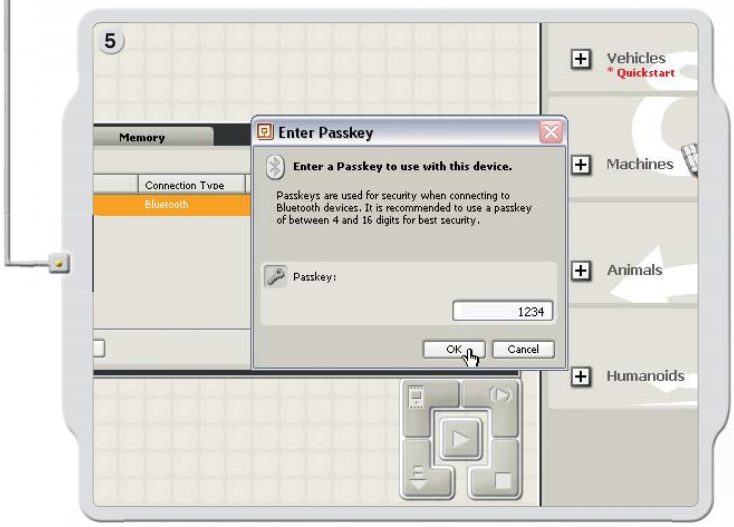


Click Scan. Your computer automatically searches for Bluetooth devices.



After a short interval, a list of devices appears in the window on the computer screen. Select the device to which you want to establish the connection and click the Connect button.

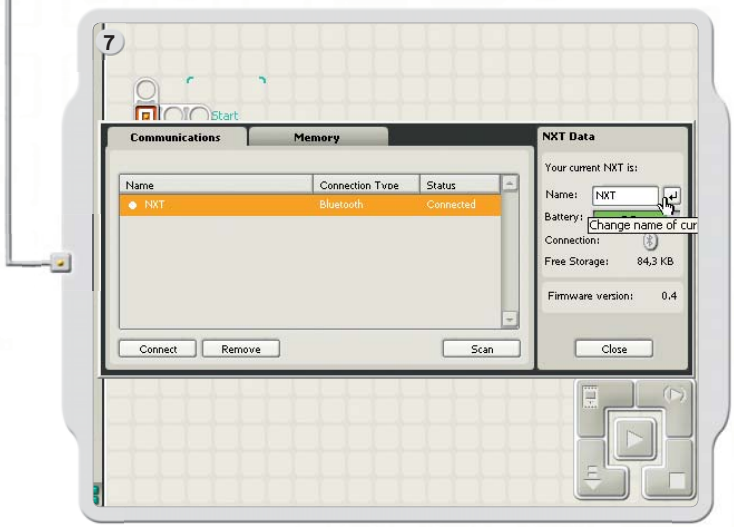
Note: You can increase the number of devices found by clicking Scan multiple times.



When you connect to a device for the first time, a Passkey window pops up. Enter the passkey to use with this device (the default passkey is 1234) and click OK.

Using Bluetooth

Enter the passkey on your NXT and confirm the connection by pressing the Orange [Enter] button. If you have chosen the default passkey, just click the Orange [Enter] button.



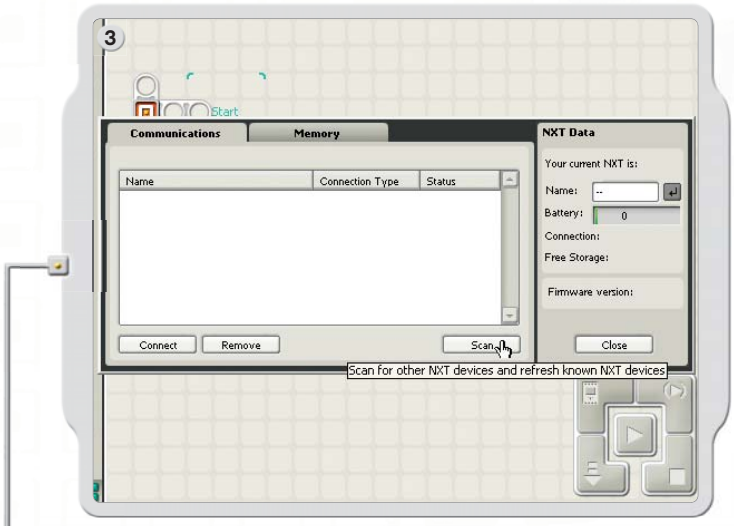
In the NXT window, the status of your NXT has now changed from Available to Connected. Your NXT and computer are now connected and can share data.

Making The Connection To A Macintosh

Make sure that the NXT is turned on. Also make sure that Bluetooth is set to On [On] and that the NXT is set to Visible. (Read how in the Bluetooth Submenu on page 40). Also make sure that Bluetooth is installed and enabled on your computer.

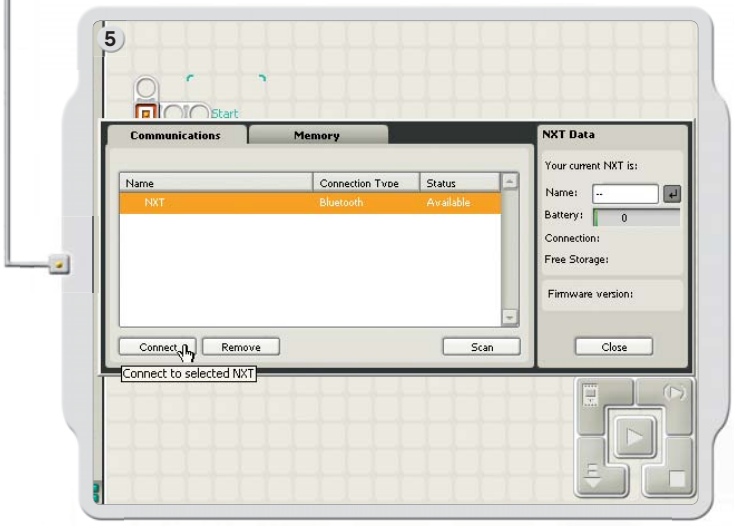
Find the Controller at the lower right work area in the software. Click on the NXT window button (the one on the upper left) and the NXT window opens.

Using Bluetooth



Click Scan. The Bluetooth device window pops onto the screen.

A list of devices appears in the Select Bluetooth Device window on the screen. Select the device to which you want to establish the connection and click the Select button.



The NXT that you want to connect to appears in the NXT window as available. Click the Connect button.

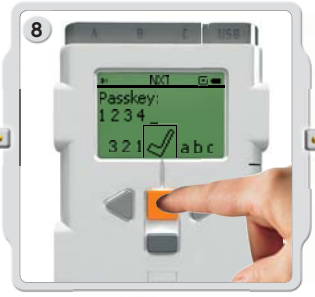
Using Bluetooth

6
Pair with a Bluetooth Device
Select a Bluetooth Device and click the Pair button.
To find devices in range of your computer to pair with, click the Search button. If your device is not found make sure it is "discoverable" and search again.
Show only: All Devices
Device Category: All Categories
Device
NXT
Search Again
Cancel
Pair

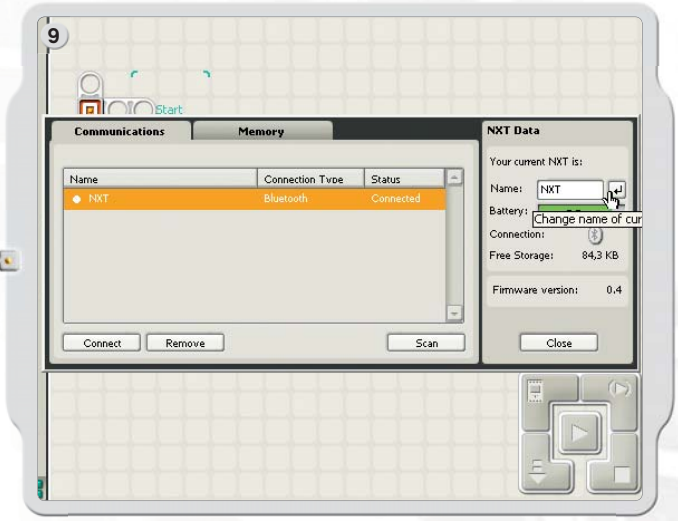
The Pair with a Bluetooth Device window pops up. Select the NXT. Click Pair.

7
Please enter a Passkey to use with this device
Passkeys are required to pair with a Bluetooth device. The same passkey must be entered on the device as well as this computer. Most devices allow you to create your own Passkey, but some devices require a fixed one.
NXT
1234
Cancel
OK
Device
NXT
Discovering Bluetooth Devices...
Search Again
Cancel
Pair

When you connect to a device for the first time, a Passkey window pops up. Enter the passkey to use with this device (the default passkey is 1234) and click OK.



Enter the passkey on your NXT and confirm the connection by pressing the Orange [Enter] button. If you have chosen the default passkey, just click the Orange [Enter] button.

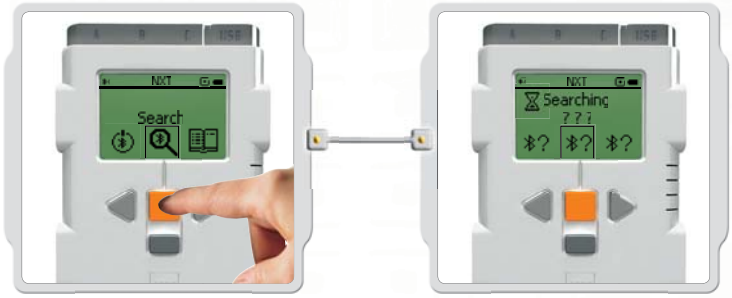


Your Macintosh and NXT are now connected and can share data.

Using Bluetooth

Bluetooth Submenu On NXT

Bluetooth
Select the Bluetooth submenu on the NXT display.



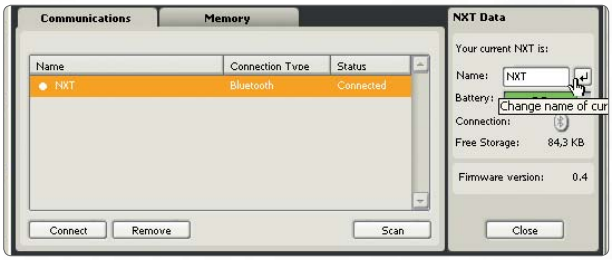
Search
Search for other Bluetooth devices. After you have chosen the Search icon, the NXT will automatically start to search for other Bluetooth devices to which it can connect.

My Contacts
This list includes the devices to which your NXT has previously been connected. Devices in this contact list can automatically connect to your NXT and send it data without using a passkey. To add devices to My Contacts [My Contacts], use the Search function.

Connections
This list includes all the devices to which your NXT is currently connected. You can connect to three items at one time (Lines 1, 2, and 3) and one can connect to you (Line 0). You can only “communicate” with one at a time.

Using Bluetooth

Bluetooth and the NXT Window



You can also view the connection status in the NXT window in the software. There you can change the name of your NXT, check the battery and memory levels, and delete programs on your NXT.

Check the connection status in the icon bar at the top of the NXT display. If there is no Bluetooth icon shown, Bluetooth is Off.

Bluetooth is On but your NXT is not visible to other Bluetooth devices.

Bluetooth is On and your NXT is visible to other Bluetooth devices.

Bluetooth is On and your NXT is connected to a Bluetooth device.

Visibility

Use the Visible option to make your NXT visible or invisible to other Bluetooth devices when they do a Bluetooth search.

Passkey

The Passkey ensures that only Bluetooth devices approved by you can connect to your NXT. Whenever you connect to a Bluetooth device for the first time using your NXT, you will be asked for a passkey. Select the preset passkey 1234 or make up your own code. Other Bluetooth devices must know your passkey in order to confirm a connection with your NXT.

On/Off

You can turn your Bluetooth function on or off. If you turn off Bluetooth, your NXT cannot send or receive data and you will have to use the USB cable for downloading programs. To save battery power, turn off the Bluetooth function when it is not in use.

Note: Bluetooth is turned off by default.

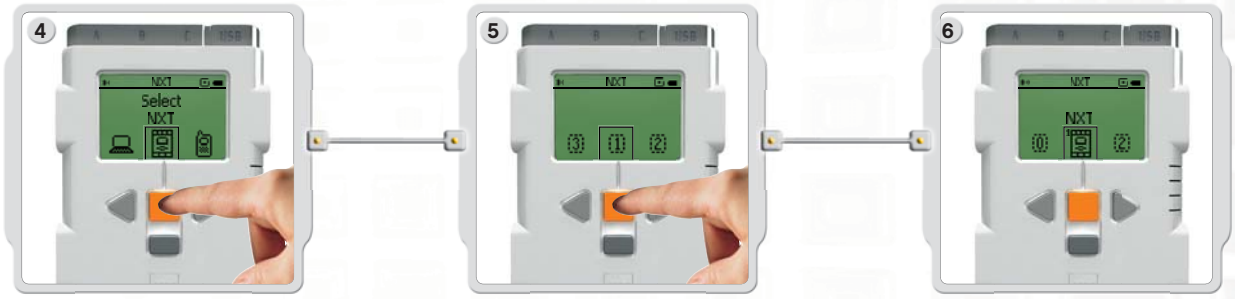
Using Bluetooth

Connecting Your NXT to Another NXT

Select the Bluetooth submenu on the NXT display.

Select the Search icon to search for other Bluetooth devices. Your NXT automatically searches for Bluetooth devices in a range of 0-30 meters (roughly 0 to 33 yards).

Depending on how many are detected in the area, the Bluetooth devices will appear in a list on the NXT display after a few seconds.



Select the device to which you want to connect. Remember that you can give each NXT a unique name – see Naming the NXT on page 13.

Select the line on which you want the connection to be listed (1, 2 or 3). You can connect your NXT to three different devices at the same time.

If you connect to a device for the first time, your NXT asks for a Passkey. Just press Enter to use the default passkey 1234 or make up your own code. The other Bluetooth device must know your passkey in order to confirm the connection. This means the two NXT bricks need to enter the same passkey in order to connect.

If you want to connect your NXT to more than one Bluetooth device, you can start a new Search or go to My Contacts submenu to select a trusted contact.

Using Bluetooth

Connecting to more than one NXT

You can connect three NXT bricks or other Bluetooth devices to your NXT at the same time. However, you can only communicate with one device at a time.

Sending files from NXT to NXT

It's easy to send programs from your NXT to another NXT:

Make sure that your NXT is connected to the NXT to which you want to send the program (see page 42, Connecting your NXT to another NXT). Select the My Files submenu in the NXT display and Select the program you want to send.

Select Send.
Select the connected devices to which you want the program sent (Lines 1, 2 or 3).

Your NXT then sends the file.

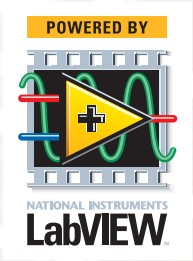
Connecting your NXT to a mobile phone

If you have a mobile phone with Bluetooth capability, you can use it with LEGO® MINDSTORMS® Education NXT.
Go to **www.MINDSTORMSeducation.com** to download the MINDSTORMS Bluetooth connection program for your mobile phone. On the website, you can also find more information on how to connect the NXT to your mobile phone.

Installing the Software

About the Software

LEGO Education and National Instruments jointly developed the LEGO® MINDSTORMS® Education NXT software. The software has an intuitive drag and drop interface and graphical programming environment that makes it easy enough for a beginner yet equally powerful for an expert. LEGO MINDSTORMS Education NXT software is an optimized version of the professional NI LabVIEW graphical programming software used by scientists and engineers worldwide to design, control and test products and systems such as MP3 and DVD players, cell phones, and vehicle air bag safety devices.



System Requirements

Before installing the LEGO® MINDSTORMS® Education NXT Software, make sure that your computer meets the system requirements.

Windows

- Intel Pentium processor or compatible, 800 MHz minimum
- Windows XP Professional or Home Edition with Service Pack 2
- 256MB of RAM minimum
- Up to 300 MB of available hard disk space
- XGA display (1024x768)
- 1 available USB port
- CD-ROM drive
- Compatible Bluetooth adapter (optional)*

Macintosh

- PowerPC G3, G4, G5 processor, 600 MHz minimum
- Apple Mac OS X 10.3.9 or 10.4
- 256 MB of RAM minimum
- Up to 300 MB of available hard disk space
- XGA display (1024 x 768)
- 1 available USB port
- CD-ROM drive
- Compatible Bluetooth adapter (optional)*

*Supported Bluetooth software includes Widcomm Bluetooth for Windows (newer than v. 1.4.2.10 SP5), and the Bluetooth stacks included in Microsoft Windows XP (with Service Pack 2) and Apple Mac OS X (10.3.9 and 10.4). For more details on compatible Bluetooth adapters, see **www.MINDSTORMSeducation.com**

Installing the Software

Microsoft Windows

Exit all open programs.
Insert the CD-ROM.
If the CD-ROM does not run automatically:
- click the Start [Start] button (at the bottom left-hand corner of the computer screen)
- click Run [Run]
- type d:\autorun.exe (where d: is your CD drive)
- Follow the on-screen instructions

Apple Macintosh

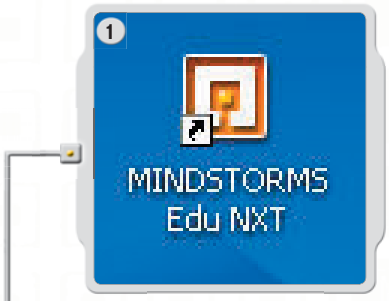
Exit all open programs.
Insert the CD-ROM.

Open the “LEGO MINDSTORMS NXT” CD-ROM and double-click Install.
Select your preferred language.
Follow the on-screen instructions.

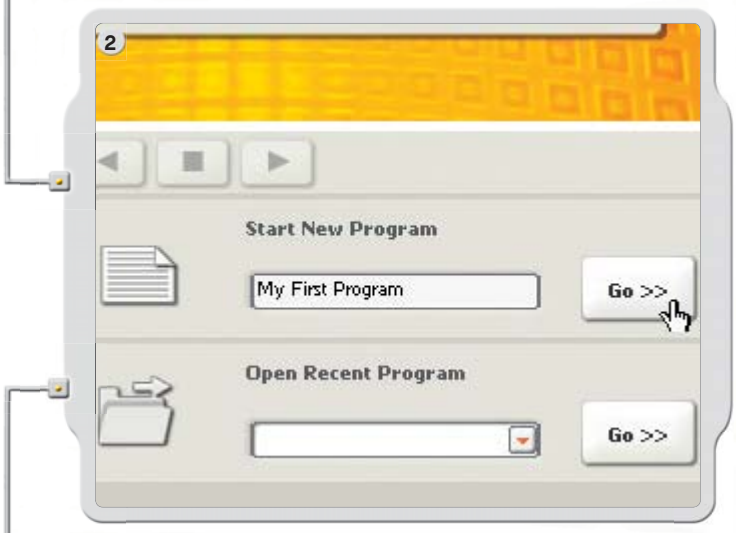
When the installation procedure is complete, click Finish. You are now ready to use the LEGO® MINDSTORMS® Education NXT Software and create programs to control robots!

Your First Program

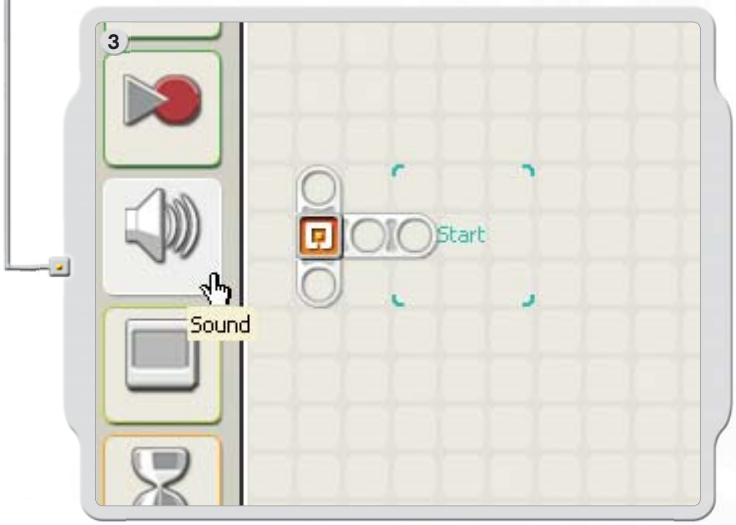
This simple program will make the NXT play a sound file.
It will help you understand how to connect your computer to the NXT.



Start the software on your PC or Macintosh by double-clicking the program icon.

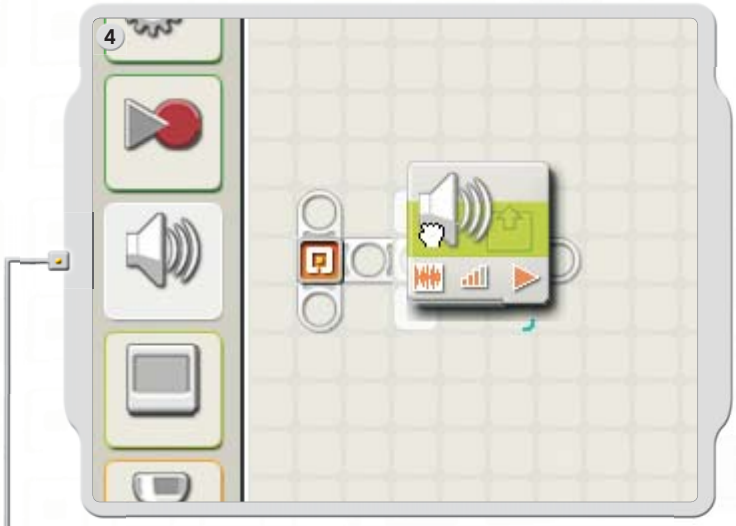


Type in the name of your first program, or just click Go!



First, click on the Sound block icon in the programming palette.

Your First Program



Drag a Sound block and drop it to the right of the Starting point in the work area.

Your program is now ready to download and run.

Make sure you turn on your NXT and connect the USB cable to both your computer and the NXT (see page 9, Connecting the NXT Technology).

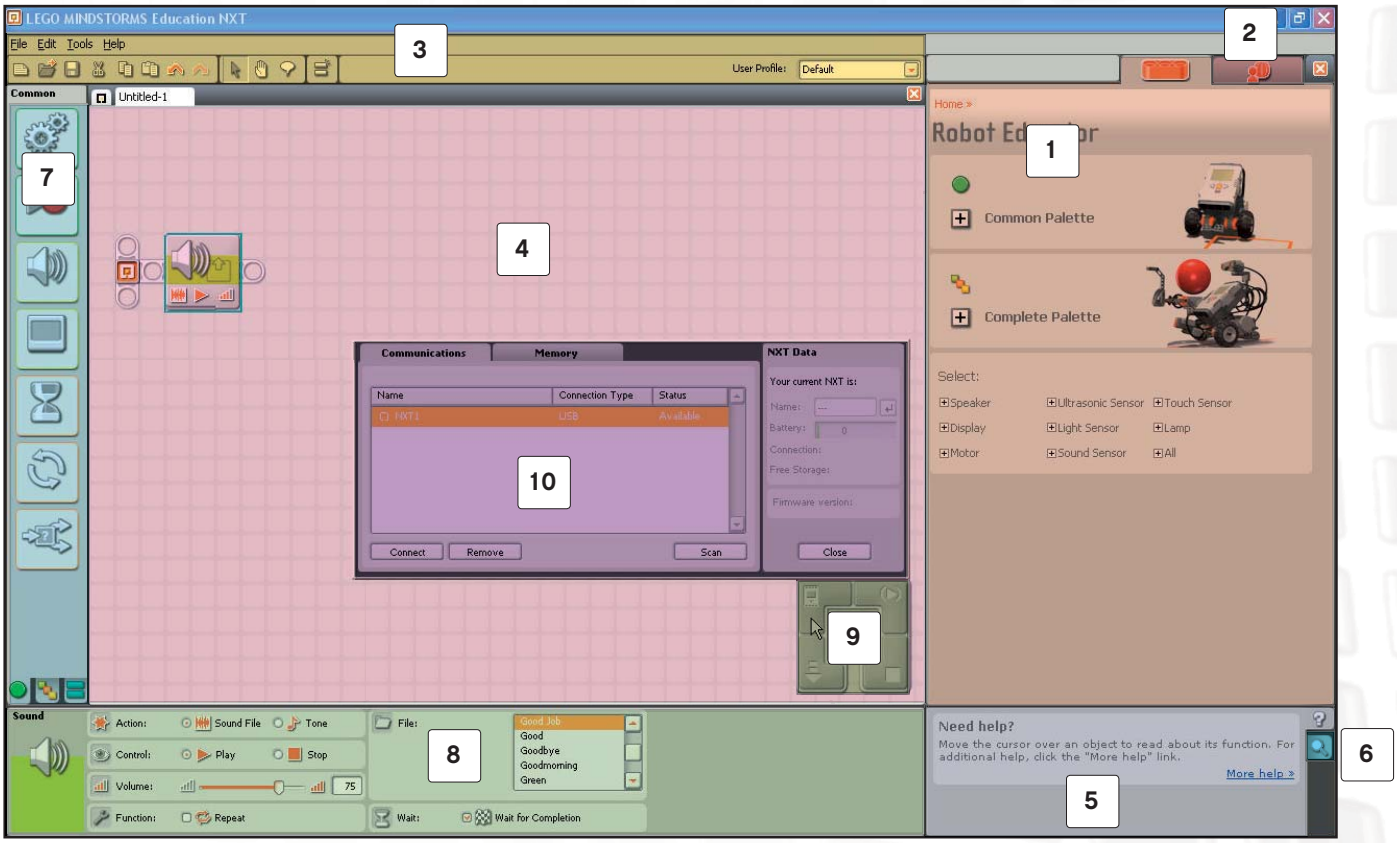
Locate the Controller in the lower right corner of the work area. Click Download and run (the center button) and listen to what happens.

Congratulations, you have completed your first program!

Software User Interface

A quick overview

1. Robot Educator
2. My Portal
3. Tool bar
4. Work area
5. Little Help window
6. Work area map
7. Programming palette
8. Configuration panel
9. Controller
10. The NXT window



Software User Interface

1 **Robot Educator**
Here you can find building and programming instructions using the Robot Educator model.

2 **My Portal**
Here you can access **www.MINDSTORMSeducation.com** for tools, downloads, and information.

3 **The tool bar**
The tool bar includes the most frequently used commands from the menu bar in an easy-to-reach location.

4 **The work area**
This is the space on the screen where programming takes place. Drag programming blocks from the programming palette to the work area and attach the blocks to the sequence beam.

5 **Little Help window**
Here you can always get help if needed.

6 **The work area map**
Use the pan tool on the tool bar to move around the work area – and use the work area map [tab in the lower right corner] to get an overview.

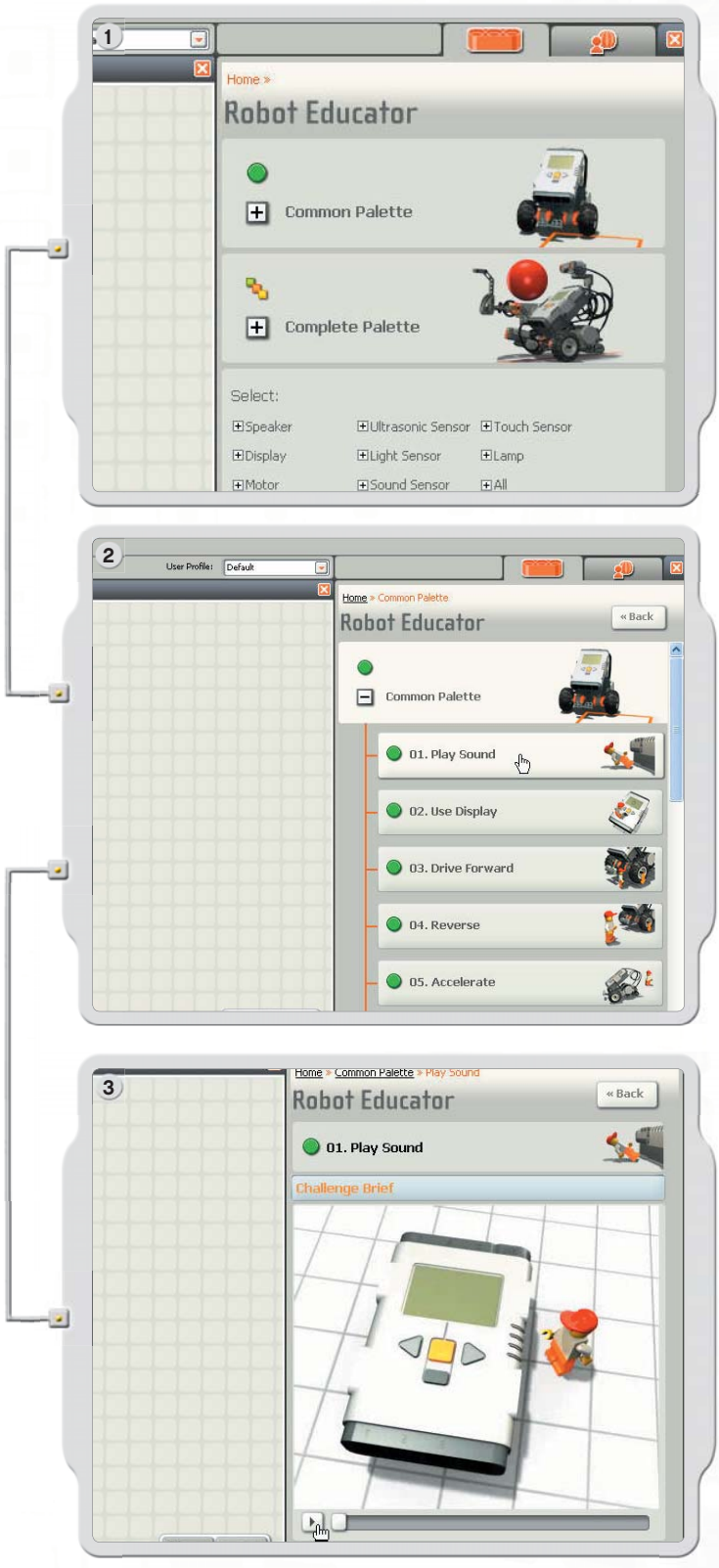
7 **The programming palette**
The programming palette contains all of the programming blocks you will need to create your programs. The tabs at the bottom of the palette let you switch between the common palette [containing the most frequently used blocks], the complete palette [containing all of the blocks], and the custom palette [containing blocks that you can download or create on your own].

8 **The configuration panel**
Each programming block has a configuration panel that lets you customize the block for the specific input and output that you want.

9 **The Controller**
The five buttons on the Controller let you download programs (or parts of programs) from your computer to the NXT. With the Controller you can also change the settings of the NXT.

10 **The NXT window**
This pop-up window provides information about the NXT memory and communication settings.

Robot Educator

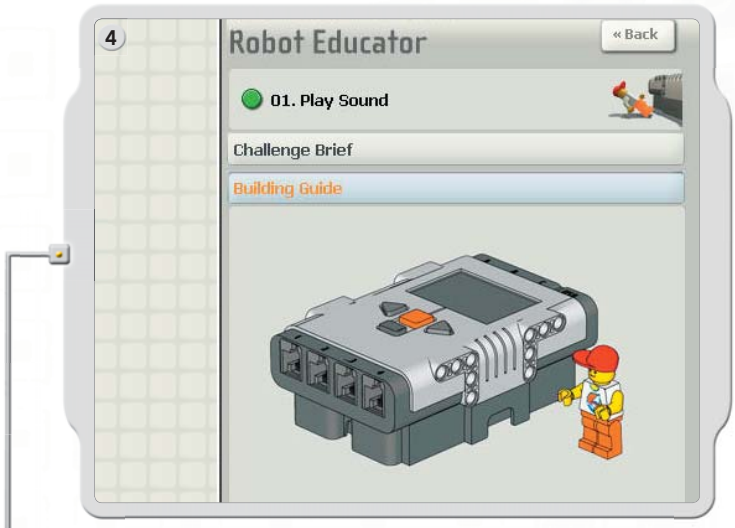


The Robot Educator is a series of tutorials that shows how to program a two-Motor robot using the main features of the LEGO® MINDSTORMS® Education NXT Software.

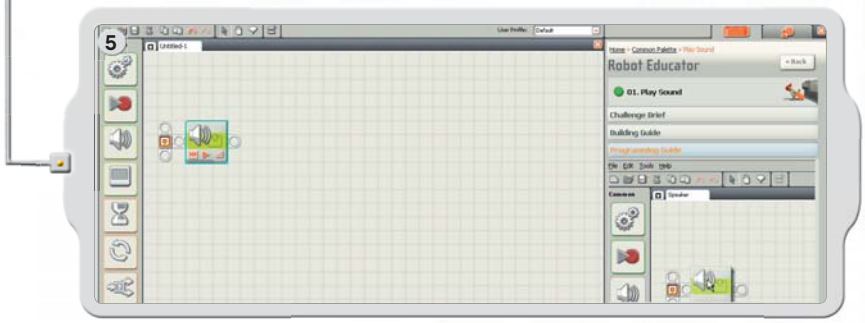
Click to see a list of challenge examples for the palette. Click again to open the example.

The challenge presents a situation to solve using the building and programming examples or on your own.

Robot Educator

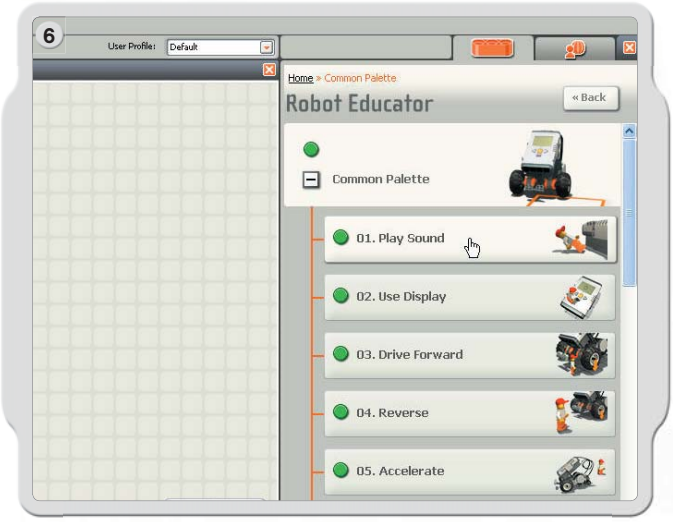


Follow the building instructions to build the Robot Educator model.



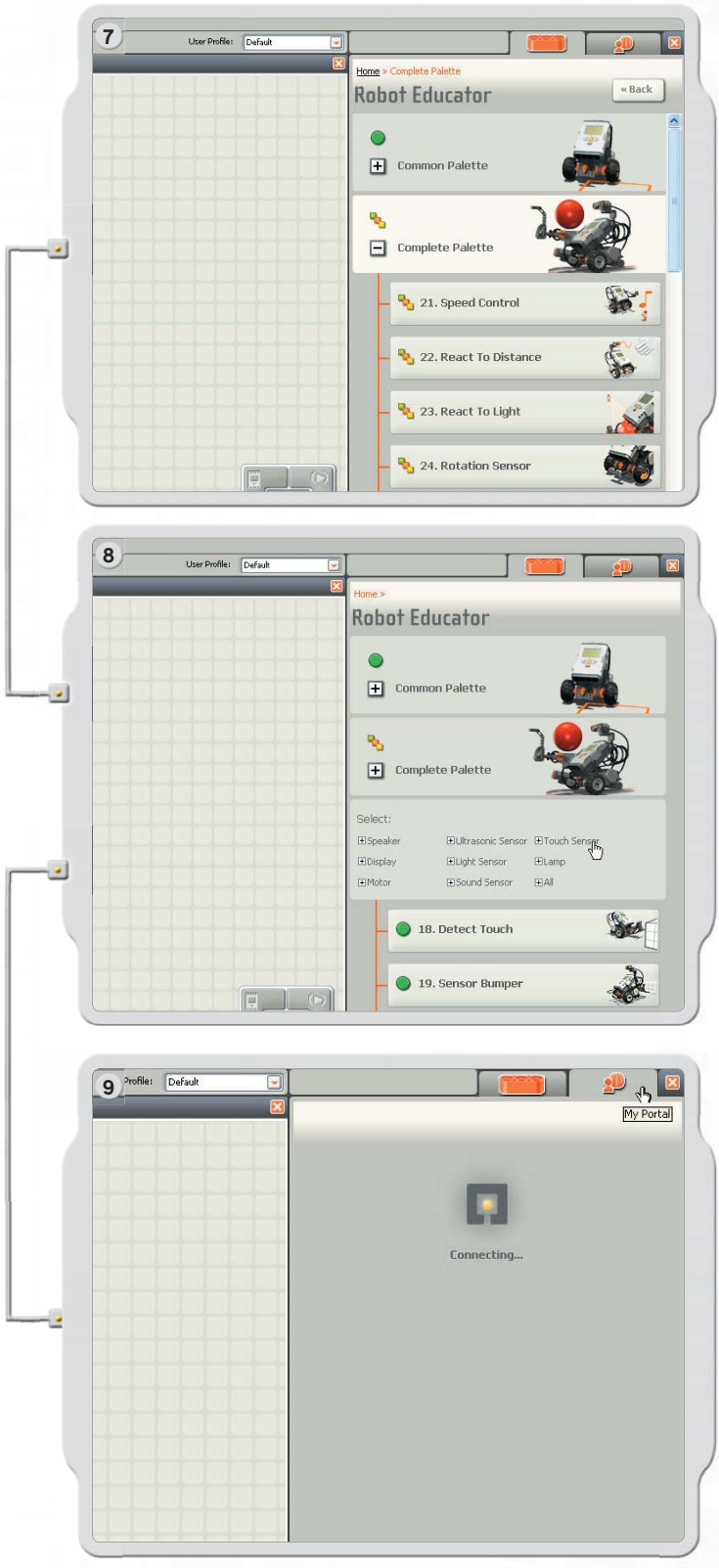
Over in the workspace, drag and drop the blocks to match the program shown in the Programming Guide.

Download the sample program to your robot and see how the robot responds!



In the Common palette are many program examples using the seven Common blocks.

The Robot Educator

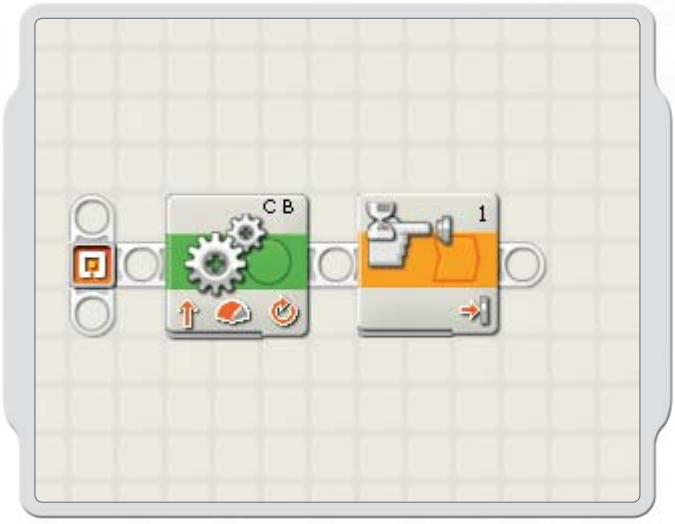


A series of examples show how the Complete palette icons can be used to program a model.

To see a list of examples for specific NXT Technology, click an item under Select.

Go to My Portal to find useful information and updates related to the LEGO® MINDSTORMS® Education NXT Software.

Programming Palette



The programming palettes contain all of the programming blocks that you need to create programs. Each programming block includes instructions the NXT can interpret. You can combine the blocks to create a program.

When you are done creating a program, you download it to the NXT. Remember to turn on and connect your NXT before downloading a program.

Programming Palette

Common Palette

To simplify its use, the programming palette has been divided into three different palette groupings: the Common palette, the Complete palette and the Custom palette (containing blocks that you create or download from the web).

The Common palette is recommended as a starting point.

Move block
The Move block makes your robot Motors move or Lamps turn on.

Record/Play block
The Record/Play block enables you to program the robot with physical movement - and later play back the movement elsewhere in the program.

Wait block
The Wait block makes your robot wait for sensor input, such as a sound or a time interval.

Sound block
The Sound block enables your robot to make sounds, including pre-recorded words.

Loop block
Use the Loop block if you want your robot to continue to do the same things again and again, such as moving forward and backward until a Touch Sensor is pressed.

Display block
The Display block enables you to control the display on the NXT. You can type, show icons or even draw through your program.

Switch block
The Switch block enables the robot to make its own decisions, such as going left when it hears a loud sound and turning right when it hears a soft sound.

Programming Palette

Complete Palette

Common blocks
The Common blocks are the same blocks available in the Common palette.

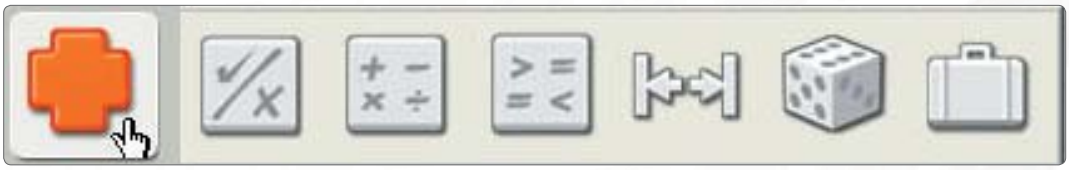
Action blocks
The Action blocks allow you to control specific types of behavior related to various output devices: the Interactive Servo Motor, NXT Sounds, NXT Display, Bluetooth (Send), Motors* and Lamps*.

Sensor blocks
Use these blocks in combination with the sensors on your robot to control behavior. The blocks correspond to Touch, Sound, Light and Ultrasonic Sensors; NXT buttons; Rotation of the Interactive Servo Motors, Timers, Bluetooth (Receive), and Touch*, Rotation*, Light*, and Temperature* Sensors.

Flow blocks
These blocks allow you to create more complex behaviors. Blocks include control for Repeat, Wait For and Variable conditions; blocks to Stop behavior or logical flow in a program; and Decision blocks to program responses to specific sensor conditions.

Programming Palette

Complete Palette



Data blocks
Set up Boolean logic, random conditions, ranges and threshold for sensors and logical comparisons using these blocks.

Advanced
Use these blocks to add text, convert data to text, control the sleep function of the NXT, save files on the NXT, calibrate sensors, and reset motors.

Custom Palette

My Blocks
Using the My Blocks, you can save a program as one block that you can then reuse in other programs.

Web Downloads
Using the Web Downloads block, you can save programs that you download from your friends' e-mail or from the Portal or from a website such as **www.MINDSTORMSeducation.com**

The Configuration Panel

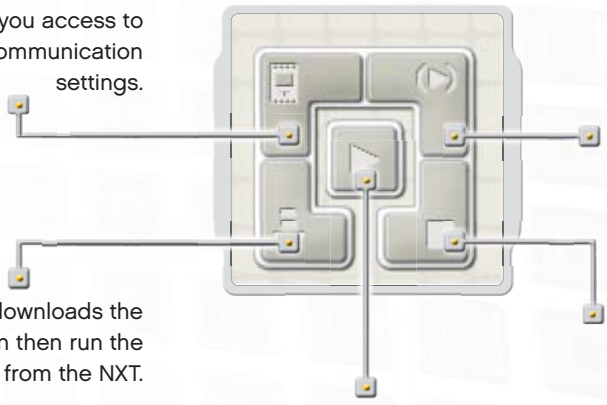
Each programming block has a configuration panel in which you can adjust the settings of the selected block. When a block is selected in the work area, its configuration panel becomes visible and active at the bottom of the screen.

By changing the parameters on each configuration panel, you can change how a particular block will behave. For example, to make your robot move faster, you can change the Power [Power] property on the Move block configuration panel.

The Controller

The five buttons on the Controller communicate from your computer to the NXT brick:

The NXT window button gives you access to the NXT memory and communication settings.



The Download and run selected button downloads and runs just a pieces of your program code (e.g. a single block or just a few blocks). You will then be able to see how the small sequence of your program performs on the NXT without having to download the whole program.

The Download button downloads the program to the NXT. You can then run the program from the NXT.

The Stop button stops a running program.

The Download and run button downloads a program to the NXT and then starts running the program.

Parts List For Base Set #9797

The LEGO® MINDSTORMS® Education NXT set #9797 is the main set for building NXT robots.
Here is a list of the building elements included in the set.

1x
448521
Minifigure, cap, red

1x
609326
Minifigure, ponytail wig, black

1x
4261269
Minifigure, head, yellow

1x
4275606
Minifigure, body, white with surfer

1x
4120158
Minifigure, legs, orange

1x
306548
Brick, 1X2, green translucent

1x
306541
Brick, 1X2, red translucent

1x
306544
Brick, 1X2, yellow translucent

2x
4299119
Hub, 18X14, grey

2x
4153005
Tire, 24X14, black

4x
4494222
Hub, 24X4, grey

4x
281526
Tire, 30.4X4, black

2x
4119589
Connector peg,
2-module double, black

2x
4211688
Connector peg, handle, grey

2x
4225033
Connector peg,
3-module double, grey

4x
4239896
½ beam, 3X5 curve, dark grey

20x
4211775
Cross block, 2-module, grey

4x
4210857
Cross block, 3-module, dark grey

8x
4121667
Cross block, double, black

4x
4113805
Bushing, axle extender, black

4x
4211432
Gear, 8-tooth, grey

4x
4211563
Gear, 16-tooth, grey

2x
4211434
Gear, 24-tooth crown, grey

2x
4211635
Gear, 20-tooth double bevel, grey

4x
4211565
Gear, 24-tooth, grey

4x
4211398
Plate, 1X2, grey

8x
4211388
Brick, 1X2, grey

4x
4211387
Brick, 2X2, grey

8x
4186017
Connector peg with axle, beige

10x
4206482
Connector peg
with friction / axle, blue

8x
4140801
Connector peg with bushing, black

10x
4239601
Bushing, ½-module, yellow

10x
4211622
Bushing, grey

2x
4211052
Tile, 1X2, dark grey

4x
4177431
Gear, 12-tooth double bevel, black

2x
471626
Gear, worm, black

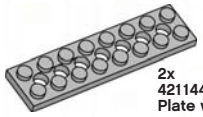
4x
4248204
Gear, 4-tooth, black

Parts List For Base Set #9797

4x
4211445
Plate, 1X4, grey

2x
4211444
Plate with holes, 2X4, grey

2x
4211542
Plate with holes, 2X6, grey



2x
4211449
Plate with holes, 2X8, grey

2x
4255563
Gear, 36-tooth , black

2x
4210655
Cross block, 2X1-module,
dark grey

2x
4107783
Angular block, 2 (180°), black

2x
4100396
Belt, 24mm, red

2x
70905
Belt, 33mm, yellow

60x
4121715
Connector peg with friction, black

36x
655826
Connector peg with friction,
3-module, black

2x
4210935
Studded beam, 1X2 with
cross hole, dark grey

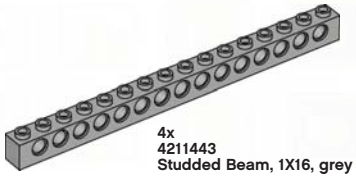
2x
4285634
Gear, 40-tooth, grey

4x
4211440
Studded Beam, 1X2, grey

4x
4211441
Studded Beam, 1X4, grey

4x
4211466
Studded Beam, 1X6, grey

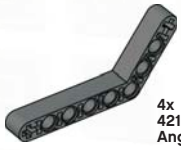
4x
4211442
Studded Beam, 1X8, grey



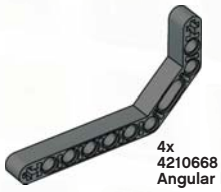
4x
4211443
Studded Beam, 1X16, grey

4x
4210667
Angular beam, 4X2-module, dark grey

8x
4210753
Angular beam, 3X5-module, dark grey



4x
4210638
Angular beam, 4X6-module, dark grey



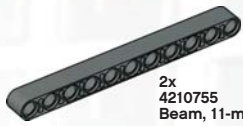
4x
4210668
Angular beam, 3X7-module, dark grey

10x
4210751
Beam, 3-module, dark grey

4x
4210686
Beam, 5-module, dark grey

4x
4495931
Beam, 7-module, dark grey

6x
4210757
Beam, 9-module, dark grey



2x
4210755
Beam, 11-module, dark grey

2x
4261932
Beam, 13-module, dark grey

4x
4210687
Beam, 15-module, dark grey

Parts List For Base Set #9797

2x
4263624
Axle, 5½-module, dark grey

8x
4142865
Axle, 2-module, red

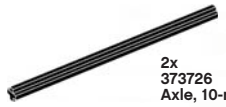
14x
4211815
Axle, 3-module, grey

8x
4211639
Axle, 5-module, grey

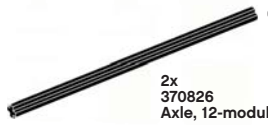
6x
370526
Axle, 4-module, black

4x
370626
Axle, 6-module, black

2x
370726
Axle, 8-module, black



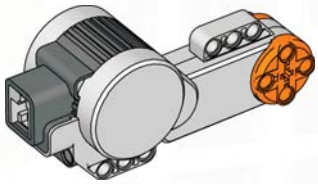
2x
373726
Axle, 10-module, black



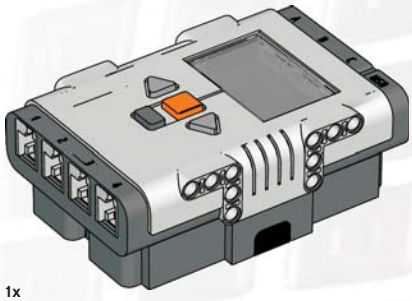
2x
370826
Axle, 12-module, black

1x
4235858
Gear/turntable, 24-tooth inner/56-tooth outer, black

3x
74880
Lamp, 1X2, white



3x
4297008
Interactive Servo Motor, NXT

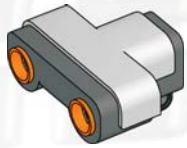


1x
4296825
NXT

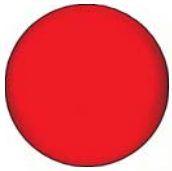
1x
4296969
Sound Sensor, NXT

1x
4296917
Light Sensor, NXT

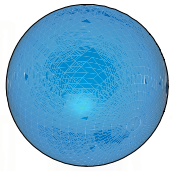
2x
4296929
Touch Sensor, NXT



1x
4297174
Ultrasonic Sensor, NXT



1x
4156530
Ball, 52mm, red



1x
4100758
Ball, 52 mm, blue

4x
4297209
Tire, 56X26, black

4x
4297210
Hub, 30X20, grey

3x
4494063
Converter cable, NXT

1x
4493444
USB cable

1x
4494062
Rechargeable battery, NXT

20 CM/8 INCH

1x
4297187
Cable, 20 cm

35 CM/14 INCH

4x
4297188
Cable, 35 cm

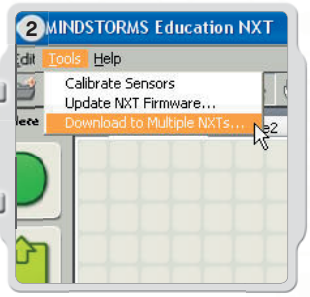
50 CM/20 INCH

2x
4297185
Cable, 50 cm

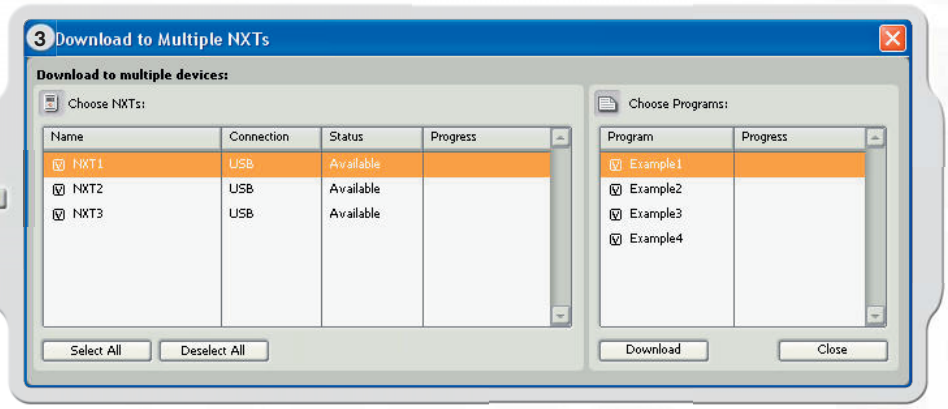
Download to Multiple NXTs

This function allows you to download one or more programs to multiple NXTs. This is especially useful if you need to load a number of NXTs with the same program(s) for a competition or classroom assignment.

Before using this function, make sure that all of the programs you would like to download are open in the software. When you open more than one program at the same time, the program names appear as tabs along the top of the work area.
Also, make sure your NXT bricks are "Available" by clicking Scan in the NXT window. Otherwise, they will not appear in the Download to Multiple NXTs window.



When the programs that you would like to download are open, launch the function by choosing Download to Multiple NXTs ... in the Tools menu. This will launch the Download to Multiple NXTs dialog box.



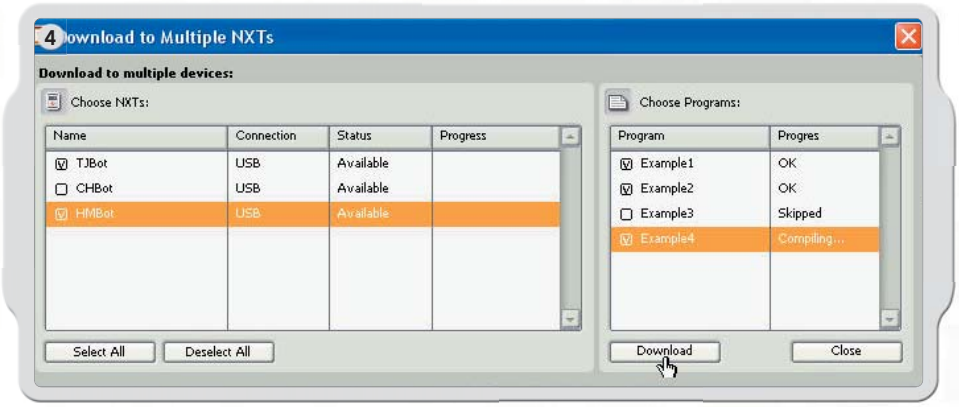
1. Choose NXTs lists all of the NXT bricks that are currently available.
2. Choose Programs lists all of the programs that are currently open.

By default, all NXTs and all programs are selected when the Download Multiple NXTs window opens.

You can click the check boxes to deselect NXTs or programs.

Download to Multiple NXTs

Note: If you do not see an NXT on the list, close the Download to Multiple NXTs window and open the NXT window. Make sure that all the NXTs have been configured in this window before opening the Download to Multiple NXTs window.



When you are ready, click the Download button below the program list. This begins the download process.
The Progress column displays the download progress.

There are several possible Status and Progress options displayed in the Choose NXT area of the Download to Multiple NXTs window.

Status:
Available – if the NXT can be selected but is not for this download.
Unavailable – if the NXT is not seen by the computer.
Connected – if the NXT is selected and ready for downloading.

Progress:
Skipped – if you did not select that program file.
Downloading – if it is in progress.
OK – when downloading that program is complete.
Error – if a problem is encountered during the downloading process.

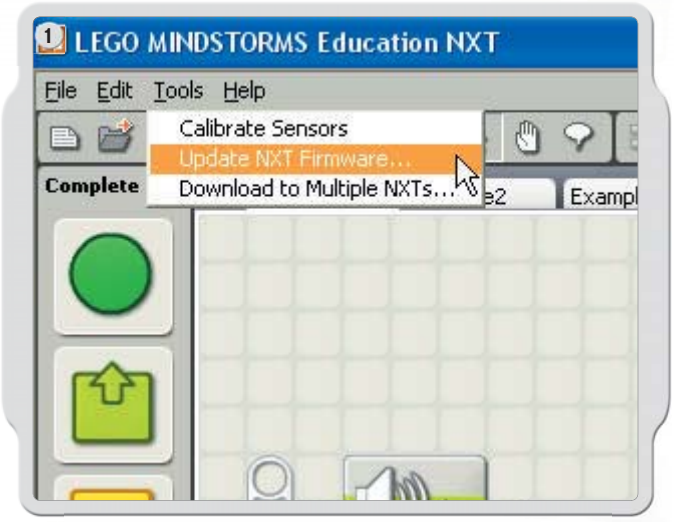
Click the Close button when you are finished downloading programs to multiple NXTs.

Troubleshooting

Resetting the NXT

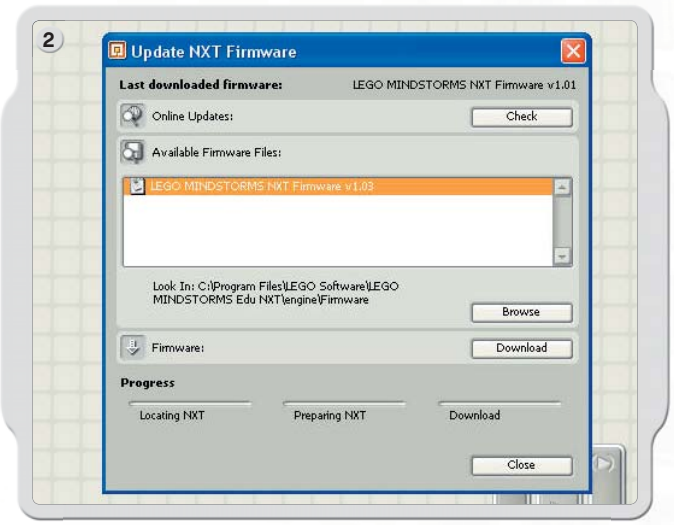
If the running icon stops spinning, the NXT has frozen and you must reset it. Follow these steps to reset the NXT:

1. Make sure that the NXT is turned on.
2. Press the reset button that is located on the back of your NXT in the LEGO® Technic hole in the upper left corner. Use, for example, an unfolded paperclip to press the button.
3. If you press the reset button for more than 4 seconds, you will need to update the firmware.



Updating the firmware in the NXT from your computer

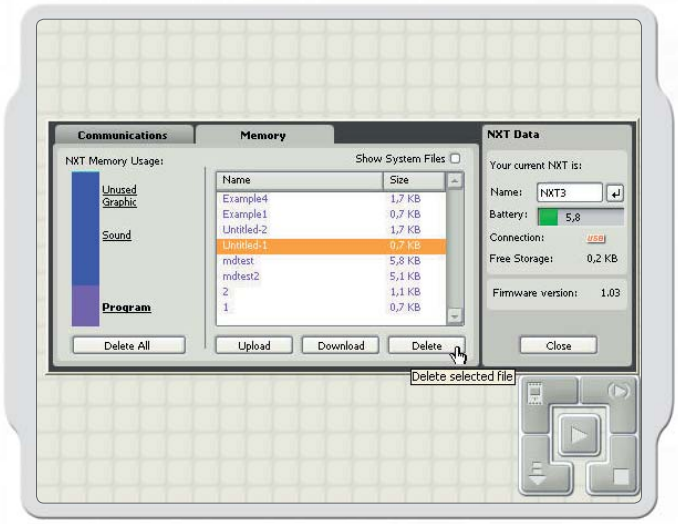
1. Make sure that the NXT is turned on. Note: If you have just reset your NXT (see above) the display will not show anything. A ticking sound will tell whether it is turned on or not.
2. Make sure the NXT and computer are connected with the USB cable.
3. Go to the Tools pull-down menu in the software menu bar and select Update NXT Firmware.



Select the firmware you want to update. Click download.

Note: The Windows “Found new hardware wizard” will pop-up the first time you update your firmware. Complete the wizard by following the on-screen instruction before you continue.

Troubleshooting



Managing NXT Memory

You can download other files to the NXT until the memory is full. When the memory is full, you can select programs to delete in order to make space.

Clicking Delete All removes only your programs, not your system files.

For more Troubleshooting help, go to www.MINDSTORMSeducation.com

Useful Information

US:
Model: LEGO MINDSTORMS NXT FCC ID:NPI53788

This device complies with part 15 of the FCC Rules.
Operation is subject to the following 2 conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received including interference that may cause undesired operation.

Warning:
Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses an can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off an on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

CAN:
Model: LEGO MINDSTORMS NXT FCC ID: NPI53788

Cet appareil est conforme aux exigences de la section 15 des règlements du Conseil supérieur de l'audiovisuel (FCC). Son fonctionnement ast soumis aux 2 conditions qui suivent:

1. Cet appareil ne peut causer de brouillage nocif.
2. Cet appareil doit accepter tout brouillage reçu y compris le brouillage pouvant engendrer un code d'opération non souhaité.

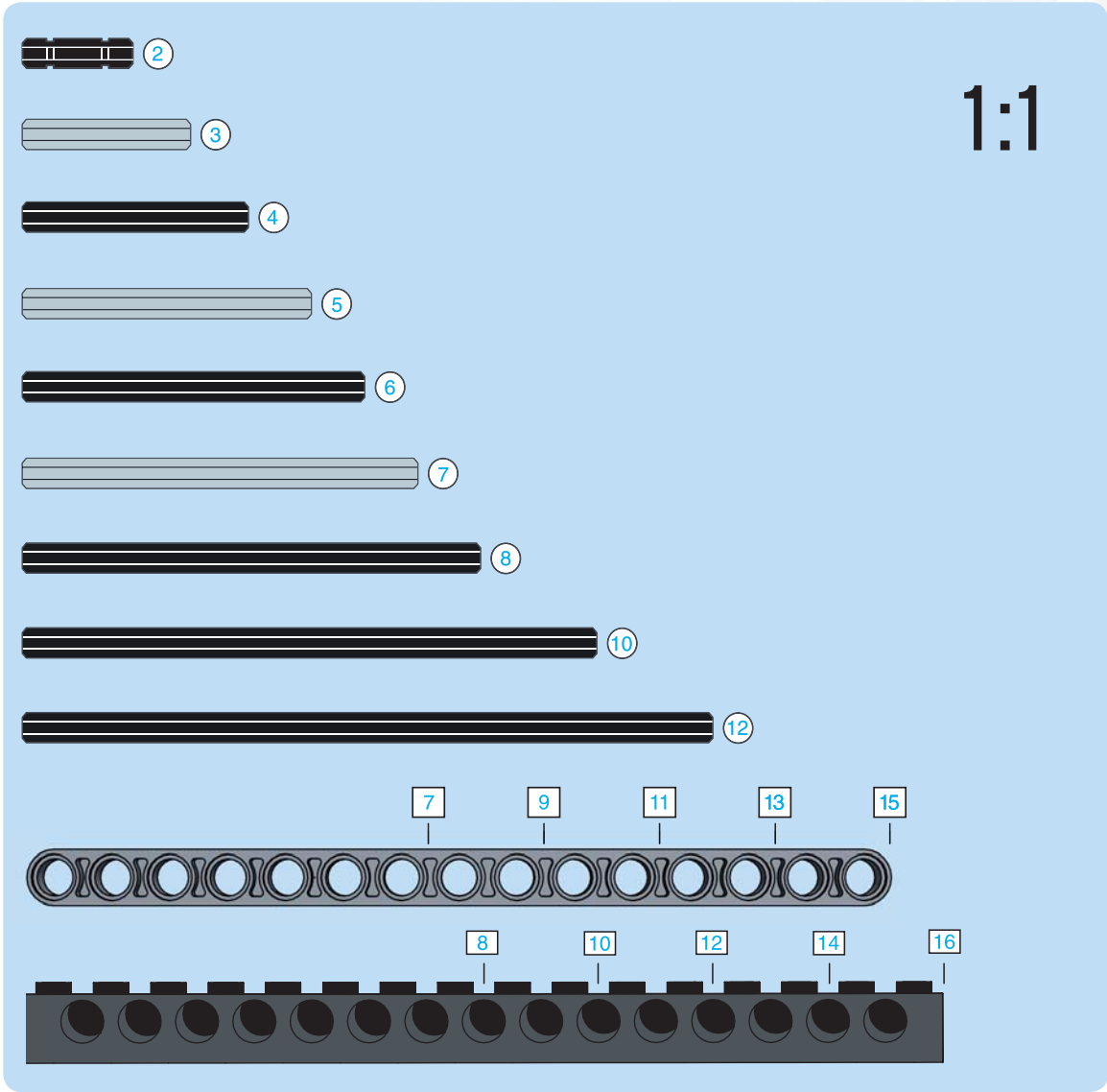
Avertissement :
Les changements ou modifications apportés à cette unité et n'ayant pas été expressément autorisés par l'équipe responsible de la conformité aux règlements pourraient annuler la permission accordée à l'utilisateur quant à l'opératuib de l'équipement.

REMARQUE :
Cet équipement a été testé et déclaré conforme aux limites définies dans la section 15 de la réglementation FCC et applicables aux appareils numériques de classe B. Ces limites sont fixées pour obtenir une protection satisfaisante contre les interférences nuisibles dans les installations résidentielles. Cet équipement produit consomme et peut émettre de l'énergie radioélectrique et il risque, s'il n'est pas installé et utilisé conformément aux instructions, de provoquer des interférences nuisibles avec les communications radio. Il est cependant impossible de garantir que des interférences ne surviendront pas dans une installation particulière. Si cet équipement est la cause d'interférences genant la réception de programmes radio ou télévisés, ce qui peut être déterminé en mettant l'appareil hors tension et de nouveau sous tension, il est demandé à l'utilisateur de tenter de remédier au problème à l'aide d'une ou plusieurs des mesures suivantes:

- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance séparant l'équipement et le récepteur.
- Raccorder l'équipement sur une sortie appatenant à un circuit différent de celui auquel le récepteur est connecté.

Consulter le revendeur ou un techicien radio-télévision expérimenté pour obtenir de l'aide.

UK:
The LEGO Group hereby declares that the LEGO® MINDSTORMS® Education Base Set (9797) complies with the requirements of the relevant provisions of EU Directive 1999/5/E.



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